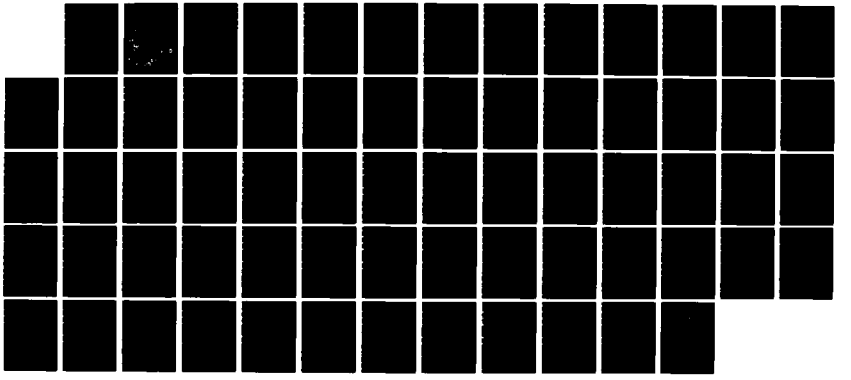
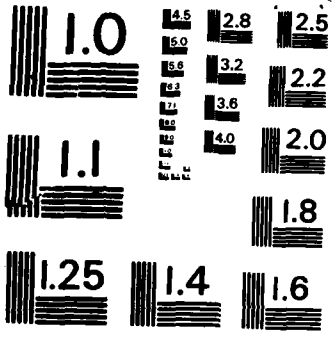
AD-A166 499 UE BENCH TEST PLANS AND REQUIREMENTS VOLUME 3 STANDARD 1/1
RECEIVER TESTS AND (U) ESSCUBE ENGINEERING INC HARLTON
NJ SEP 84 CER/GPS-85-156-00-030 N62269-82-D-0059
UNCLASSIFIED F/G 9/2 NL





GPS-85-156-00-030

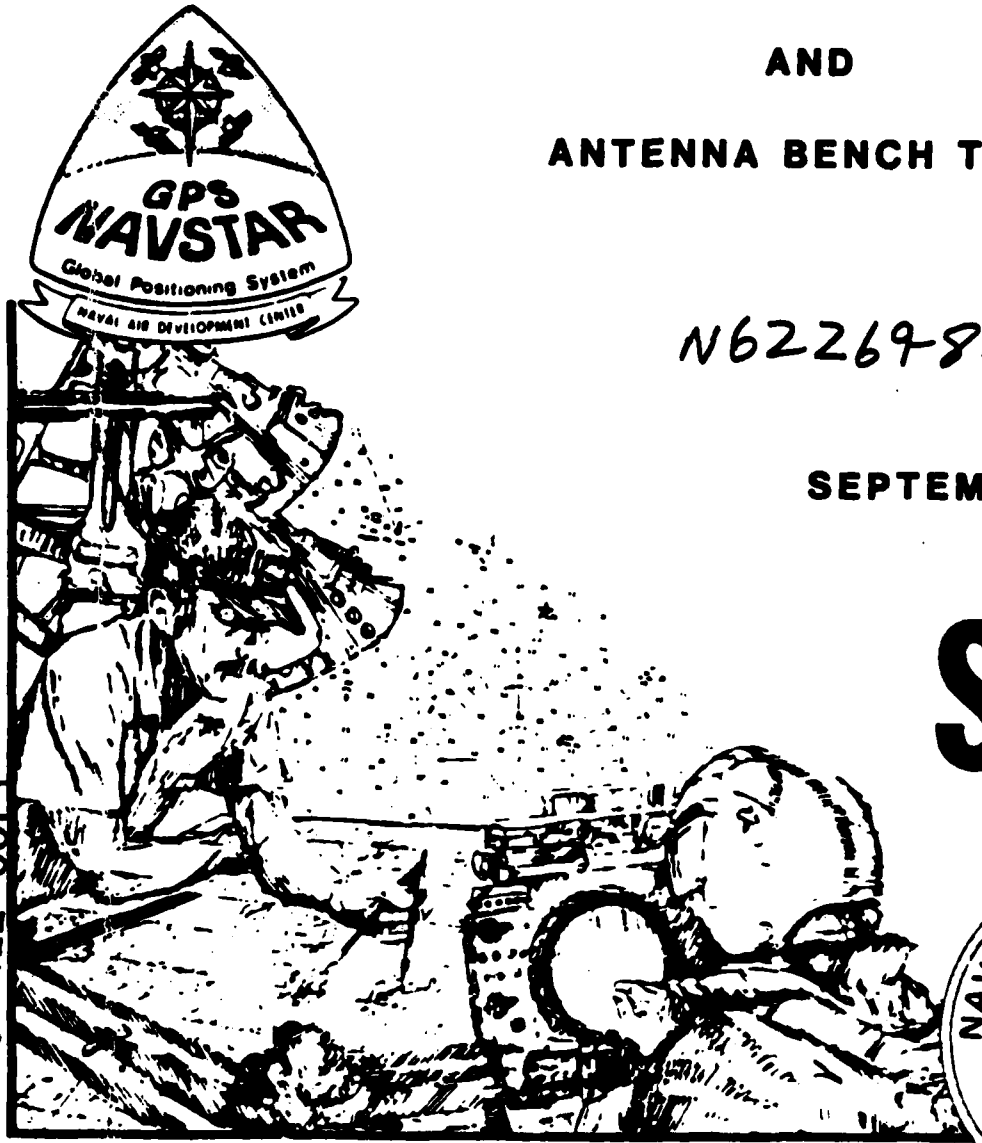
RF LABORATORY

UE BENCH TEST PLANS AND REQUIREMENTS

VOLUME 3. STANDARD RECEIVER TESTS

AND

ANTENNA BENCH TESTS



N62269-82-D-0059

SEPTEMBER 1984

NAVY SPACE PROGRAM PDE-106

PREPARED FOR NAVAL ELECTRONIC SYSTEMS COMMAND

UE BENCH TEST PLANS
AND REQUIREMENTS

VOLUME 3. STANDARD RECEIVER TESTS AND ANTENNA BENCH TESTS

SEPTEMBER 1984

CEA-RFL-84-005

Prepared for:

Naval Air Development Center

Warminster, PA 18974

TABLE OF CONTENTS

GPS UE BENCH TEST PLANS AND REQUIREMENTS
VOLUME 3

1.0 PURPOSE

The purpose of this report is to provide a basis for defining the hardware and software required to perform Standard Receiver test and Antenna bench tests in the RF Laboratory of the GPS Central Engineering Activity at NAVAIRDEVCEN. For additional background information, see Volume 1.

1.1 SCOPE

This report contains general test requirements for each test defining the:

- level of test (UE, board, component),
- test objective (parameter/function),
- test inputs,
- tests outputs,
- equipment required for each input/output,
- initial test procedure,
- data reduction requirements,
- summary list of test equipment (standard/special),
- block diagram of test.

It is divided into four sections. Sections 3.1 and 3.2 deal with Standard Receiver tests and Antenna Bench tests respectively for both the Magnavox and Rockwell-Collins UE sets. The Antenna Bench tests will be computer controlled and will require special software to control the conditions, parameters and data collection needs of the test.

A section on special software requirements is provided which defines the software needs of each test in terms of flowcharts.

A section on special hardware requirements defining special test hardware that will be required to perform these tests on both the Magnavox and Rockwell-Collins UE sets is also included. It is limited, however, by the amount of information currently available on design and performance of UE RF functions.

2.0 LIST OF REFERENCE DOCUMENTS

1.	ICD-GPS-204	GPS Instrumentation and Connector Standards	5 June 1981
2.	Harris	LRU Performance Test Procedures CRPA 1, 2, and 3	15 April 1982

3.0 GENERAL TEST REQUIREMENTS

This section contains test requirements and procedures for receiver and antenna testing for both Magnavox and Collins.

3.1 RECEIVER TEST REQUIREMENTS

The receiver tests are standard performance tests which will measure the receiver's ability to acquire, track and demodulate GPS signals and data under a variety of conditions. These tests can be performed before and after developmental testing in order to compare performance at later stages in development to a baseline performance level. These will be performed using the Satellite Signal Generator (SSG) as the stimulus equipment. Data collection will require special purpose hardware which will be discussed in Section 5.0, and will be collected via the Instrumentation Port where possible.

3.1.1 Receiver Test Procedures

The following sheets contain the initial test requirements and procedures as listed in Section 1.1 for both the Magnavox and Collins receivers. These sheets will be refined and new sheets will be added as more information becomes available.

3.1.1.1 MAGNAVOX AND COLLINS STANDARD RECEIVER TEST PROCEDURES

Contractor: Magnavox/Collins

Board Tested: Standard Receiver Tests 1-5

Test Objective: To measure time to acquire under various conditions of signal strength, jamming, frequency choice, etc. (Tests # 3, 4 for 5 channel sets only).

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz (Test # 1,3,5)	1227.6MHz @ -163dBw	Satellite Signal Generator
2.	1575.42MHz (Test # 2)	1227.6MHz @ -150dBw	Satellite Signal Generator
3.	1227.6MHz (Test # 4)	1575.42MHz @ -163dBw	Satellite Signal Generator
4.	C/A Code (Test # 1,2,5)	TBD	Satellite Signal Generator
5.	P Code (Test # 3,4)	TBD	Satellite Signal Generator
6.	GPS Data (# 1-5)	TBD	Satellite Signal Generator
7.	Noise Modulated Jammer (# 1)	-139dBw100kHz BW @ 1227.6MHz	Satellite Signal Generator
8.	Noise Modulated Jammer (# 5)	-129dBw2MHz BW @ 1227.6MHz	Satellite Signal Generator
9.	CW Jammer (# 3,4)	-139dBw1575.42MHz	Satellite Signal Generator
10.	Dynamic Profile Attached	TBD	Satellite Signal Generator
11.			
12.			

* Test #5 requires that receiver undergo a cold soak at -40°C prior to testing.

Outputs

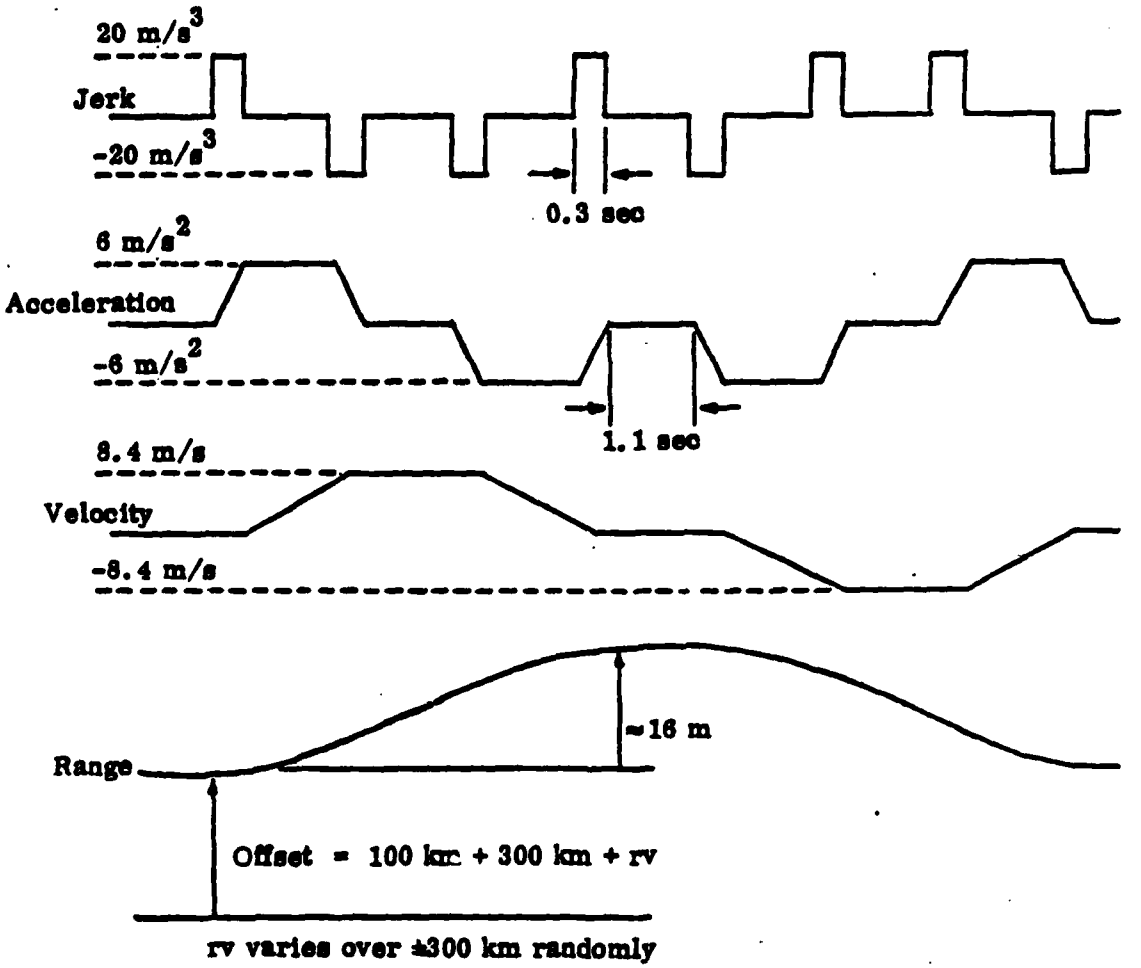
	Output Name	Output Level	Equipment Used
1.	Time to Acquire	TBD	TBD
2.			
3.			
4.			
5.			

Test Procedure: Inject signal from Satellite Signal Generator into receiver front end (SSG signal for each test will be a combination of GPS and jamming signals, altered as necessary to simulate host vehicle dynamics, at the levels shown on page one for each test). Observe and record time to acquire GPS signals. Acquisition will be considered complete upon successful code lock and HOW demodulation. Receiver shall operate in State 1 for tests 1,2 and 5 and State 2 for tests 3 and 4.

Data Reduction: Time to acquire will be recorded as will all input levels and conditions.

Equipment List:

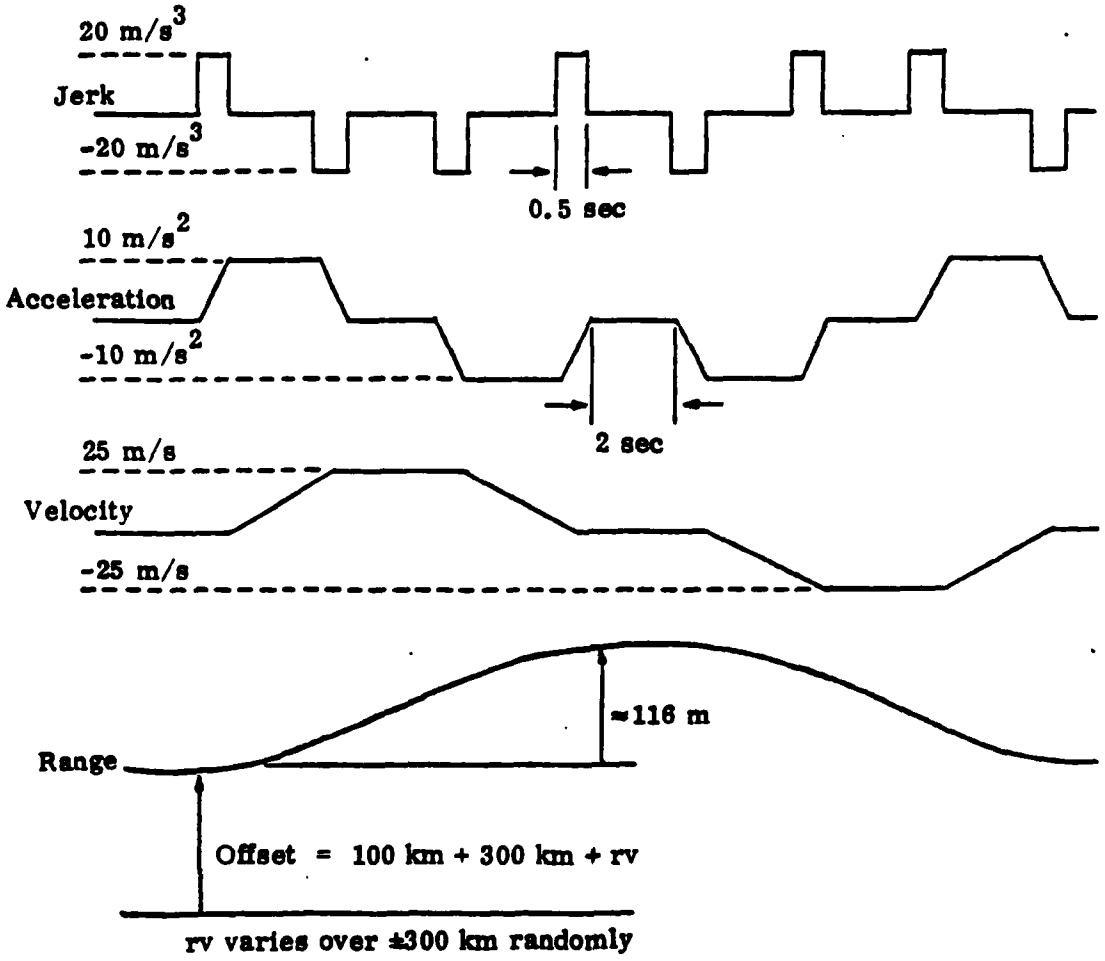
1.	Satellite Signal Gen.	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	



Note: Jerk from SS-US-200, Table II, Category A
Acceleration from SS-US-200, 10.3.7.2.2.2
One sigma velocity from SS-US-200, 10.3.7.2.2
Position/time from SS-US-200, Table II, Category A
Time limited to 20 ms

FOR TESTS: 1,2,5

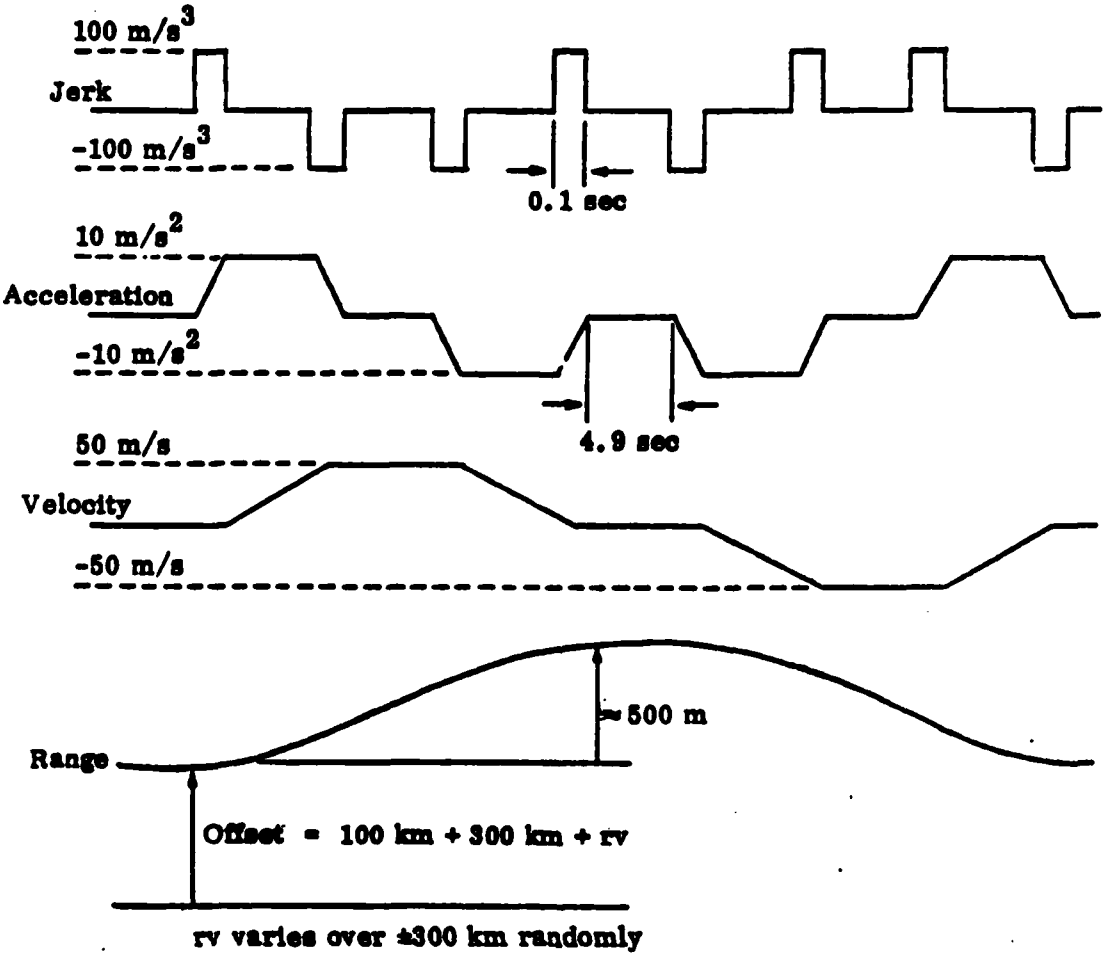
Dynamic Profile — One Channel Receiver Normal (C/A) Acquisition



Note: Jerk from SS-US-200, Table II, Category A
Acceleration from SS-US-200, Table II, Category A
Velocity (one sigma) from SS-US-200, Table II, Category A
Position from SS-US-200, Table II, Category A
Time limited to 20 ms

FOR TESTS: 1,2,5

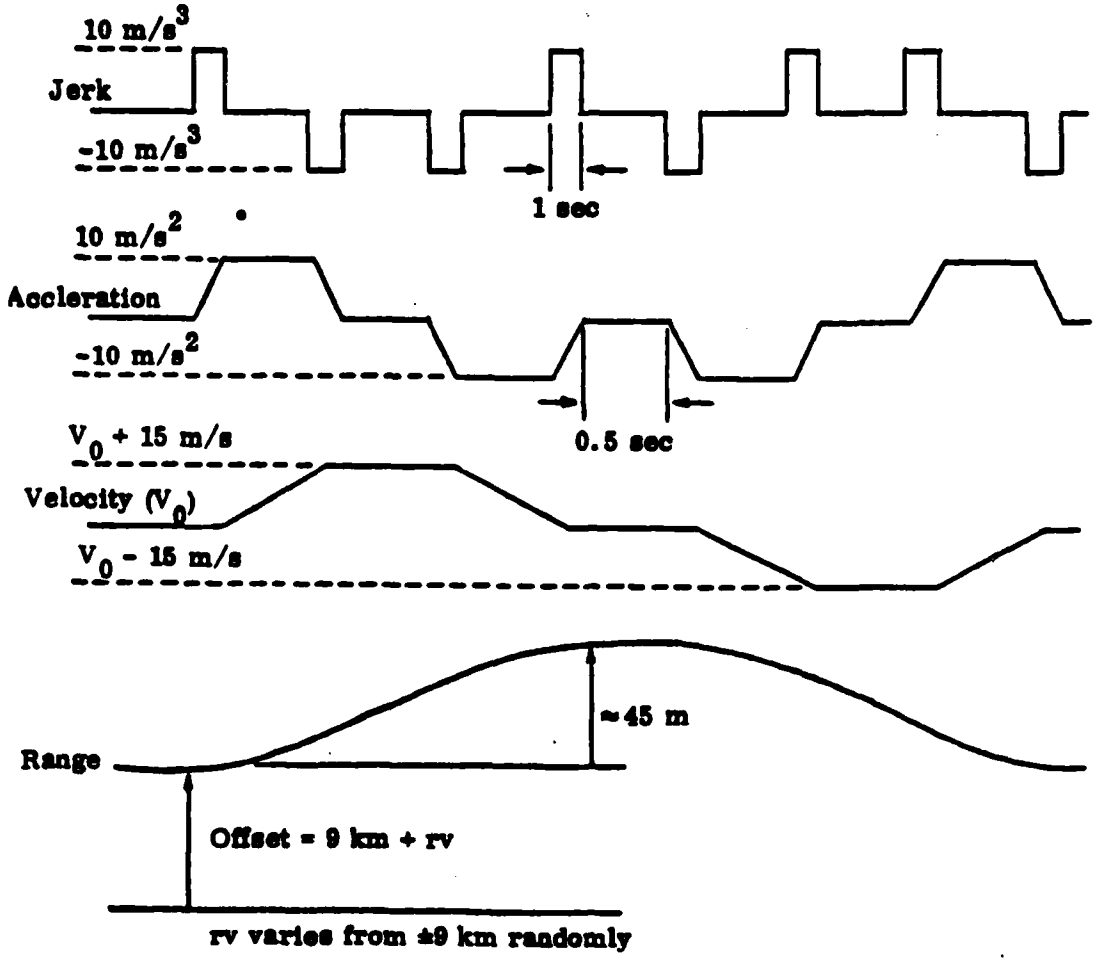
Dynamic Profile — Two Channel Receiver Normal (C/A) Acquisition



Note: Jerk from SS-US-200, 30.3.7.2.2.1
Acceleration from SS-US-200, Table II, Category A
Velocity from SS-US-200, 30.3.7.2.2.1
Range from SS-US-200, Table II, Category A
Time limited to 20 ms

FOR TESTS: 1,2,5

Dynamic Profile — Five Channel Receiver Normal (C/A) Acquisition



Note: Jerk from SS-US-200, Table II, Category C
Acceleration from SS-US-200, Table II, Category C
Velocity (3 sigma) from SS-US-200, Table II, Category C
Range from SS-US-200, Table II, Category C
Time from SS-US-200, Table II, Category C

$$18 \text{ km} = \sqrt{10^2 \text{ km} + 15.3^2 \text{ km}}$$

FOR TESTS: 3,4

Dynamic Profile — Five Channel Receiver Direct P Acquisition

Contractor: Magnavox/Collins

Board Tested: Standard Receiver Tests 6-12

Test Objective: To measure tracking reliability under various conditions of signal strength, jamming, frequency choice, etc... (5 channel sets only)

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz (Test # 6,7,8)	1227.6MHz @ -163dBw	Satellite Signal Generator
2.	1227.6MHz (Test # 9-12)	1575.42MHz @ -163dBw	Satellite Signal Generator
3.	C/A Code (Test # 8,9)	TBD	Satellite Signal Generator
4.	P Code (Test # 6,7,10-12)	TBD	Satellite Signal Generator
5.	GPS Data (Test # 6-12)	TBD	Satellite Signal Generator
6.	CW Jammer (Test # 6,10)	GPS frequency at -122dBw	Satellite Signal Generator
7.	CW Jammer (Test # 12)	1575.42MHz @ -116dBw	Satellite Signal Generator
8.	*Pulsed CW Jammer (Test # 7,11)	GPS frequency @ -122dBw	Satellite Signal Generator
9.	Noise Mod. Jammer (Test # 8,9)	-132dBw 100kHz BW @ GPS Freq.	Satellite Signal Generator
10.	Dynamic Profile Attached	TBD	Satellite Signal Generator
11.			
12.			

* Pulse width equals 1 μsec. Pulse interval 0.1 to 10 msec.

Outputs

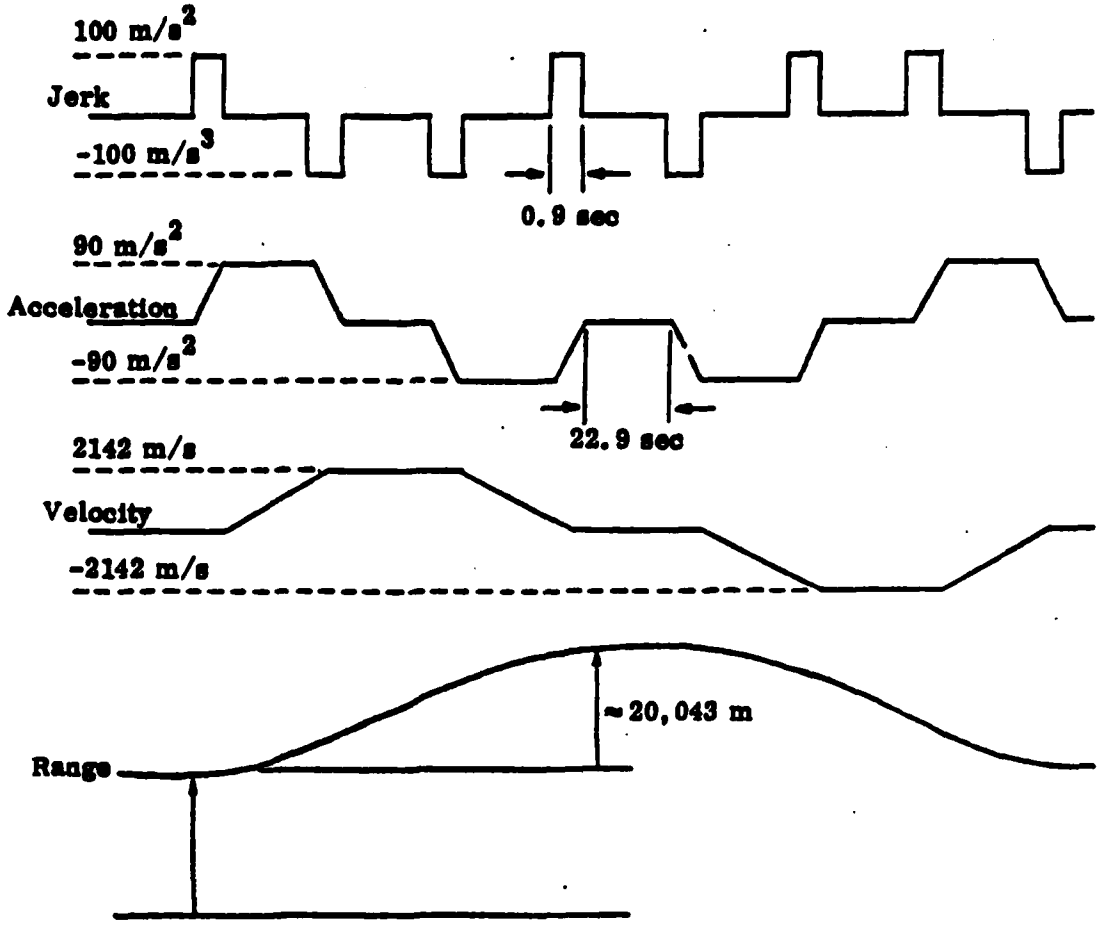
	Output Name	Output Level	Equipment Used
1.	Delta Range	TBD	TBD (inst. Port)
2.	Pseudo Range	TBD	TBD
3.	Loss of Track	----	TBD
4.			
5.			

Test Procedure: Inject signal from Satellite Signal Generator into receiver front end (SSG signal for each test will be a combination of GPS and jamming signals, altered as necessary to simulate host vehicle dynamics, at the levels shown on page one for each test). Observe and record DR, PR and Loss of Lock. Receiver shall operate in State 5 for all tests. Dynamic profile for tests 8, 10 and 12 will be constant 900m/sec velocity. Profiles for other tests are attached.

Data Reduction: DR, PR, any loss of lock and all input levels and conditions will be recorded for each test.

Equipment List:

1.	SSG	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	



Note: Jerk from SS-US-200, 40.3.2.1.11
Acceleration from SS-US-200, 40.3.2.1.11
Velocity from SS-US-200, Table IV-IV, plus SV max velocity of 940 m/s

FOR TESTS: 6,7,9,11

Dynamic Profile — Five Channel Receiver Tracking Tests

Contractor: Magnavox/Collins

Board Tested: Standard Receiver Tests 13-16

Test Objective: To measure the pseudo range and delta range accuracy for one and two channel sets under various conditions.

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz (Test # 13, 14)	1227.6MHz @ -163dBw	Satellite Signal Generator
2.	1227.6MHz (Test # 15, 16)	1575.42MHz @ -163dBw	Satellite Signal Generator
3.	C/A Code (Test # 14, 15)	TBD	Satellite Signal Generator
4.	P Code (Test # 13, 16)	TBD	Satellite Signal Generator
5.	GPS data (Test # 13-16)	TBD	Satellite Signal Generator
6.	CW Jammer (13, 16)	GPS frequency @ -123dBw	Satellite Signal Generator
7.	Noise Mod. Jammer (14)	1227.6MHz at -133dBw (10MHz BW)	Satellite Signal Generator
8.	Noise Mod. Jammer (15)	1575.42MHz @ -133dBw (100kHz BW)	Satellite Signal Generator
9.	Dynamic Profile Attached	TBD	Satellite Signal Generator
10.			
11.			
12.			

Outputs

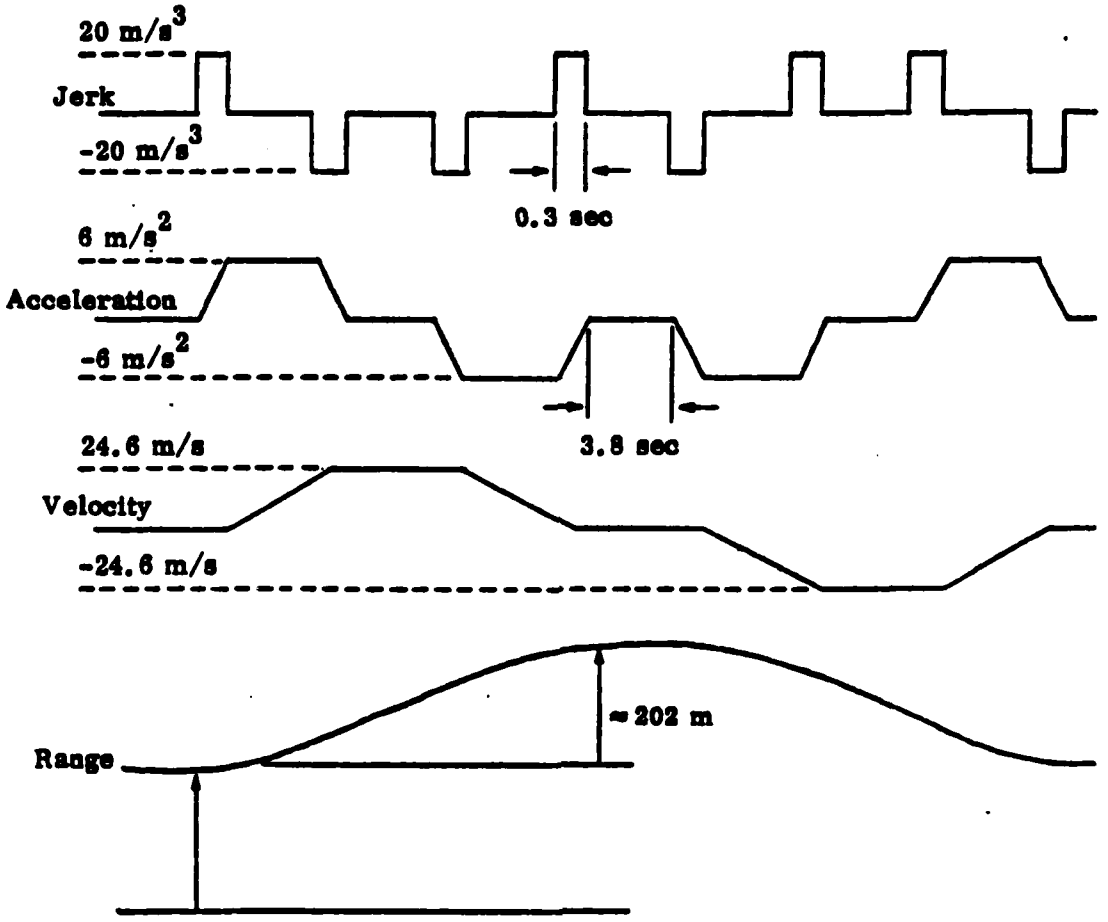
	Output Name	Output Level	Equipment Used
1.	PR	TBD	TBD (Inst Port)
2.	DR	TBD	TBD (Inst Port)
3.			
4.			
5.			

Test Procedure: Inject signal from Satellite Signal Generator into receiver front end (SSG signal for each test will be a combination of GPS and jamming signals, altered as necessary to simulate host vehicle dynamics, at the levels shown on page one for each test). Observe and record DR and PR. Receiver shall operate in substate 5 of state 6 for all tests. Dynamic Profile for tests 13 and 15 will be constant 900m/sec velocity. Profiles for other tests are attached.

Data Reduction: DR, PR and all input levels and conditions will be recorded for each test.

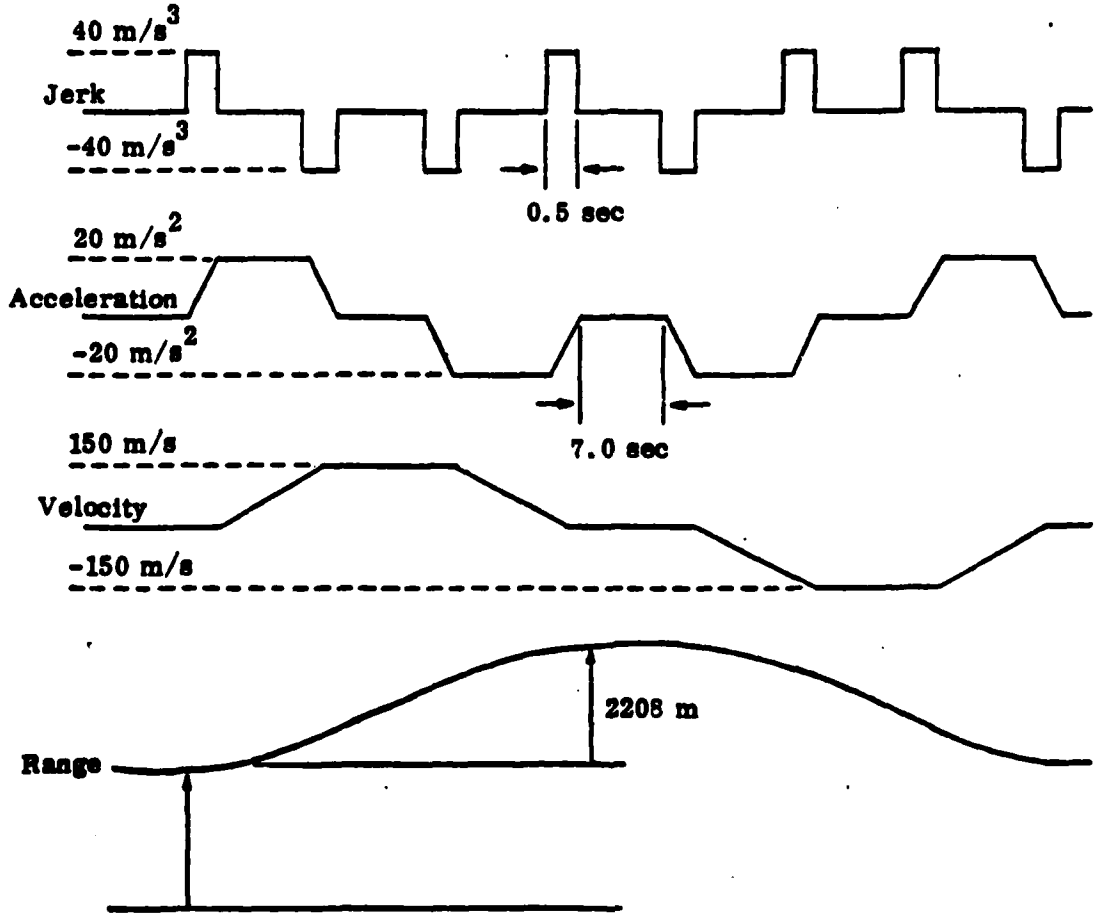
Equipment List:

1.	SSG	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	



Note: Jerk from SS-US-200, Table II, Category A
Acceleration from SS-US-200, Table I-IV
Velocity from SS-US-200, Table I-IV

Dynamic Profile — One Channel Receiver Sequencing Tests



Note: Jerk from SS-US-200, Table II-IV
Accleration from SS-US-200, 20.3.2.1.11
Velocity from SS-US-200, Table II-V

Dynamic Profile — Two Channel Receiver Sequencing Tests

Contractor: Magnavox/Collins

Board Tested: Standard Receiver Tests 17-20

Test Objective: To measure reacquisition time for five channel sets under various conditions.

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz (17, 18)	1227.6MHz at -163dBw	Satellite Signal Generator
2.	1227.6MHz (19, 20)	1575.42MHz @ -163dBw	Satellite Signal Generator
3.	C/A Code (18, 20)	TBD	Satellite Signal Generator
4.	P Code (17, 19)	TBD	Satellite Signal Generator
5.	GPS Data (17-20)	TBD	Satellite Signal Generator
6.	CW Jammer (17, 19)	GPS freq. @ -123dBw	Satellite Signal Generator
7.	Noise Mod. Jammer (18)	1227.6MHz at -133dBw (2MHz BW)	Satellite Signal Generator
8.	Noise Mod. Jammer (20)	1575.42MHz @ -133dBw (10MHz BW)	Satellite Signal Generator
9.	Dynamic Profile Attached	TBD	Satellite Signal Generator
10.			
11.			
12.			

Outputs

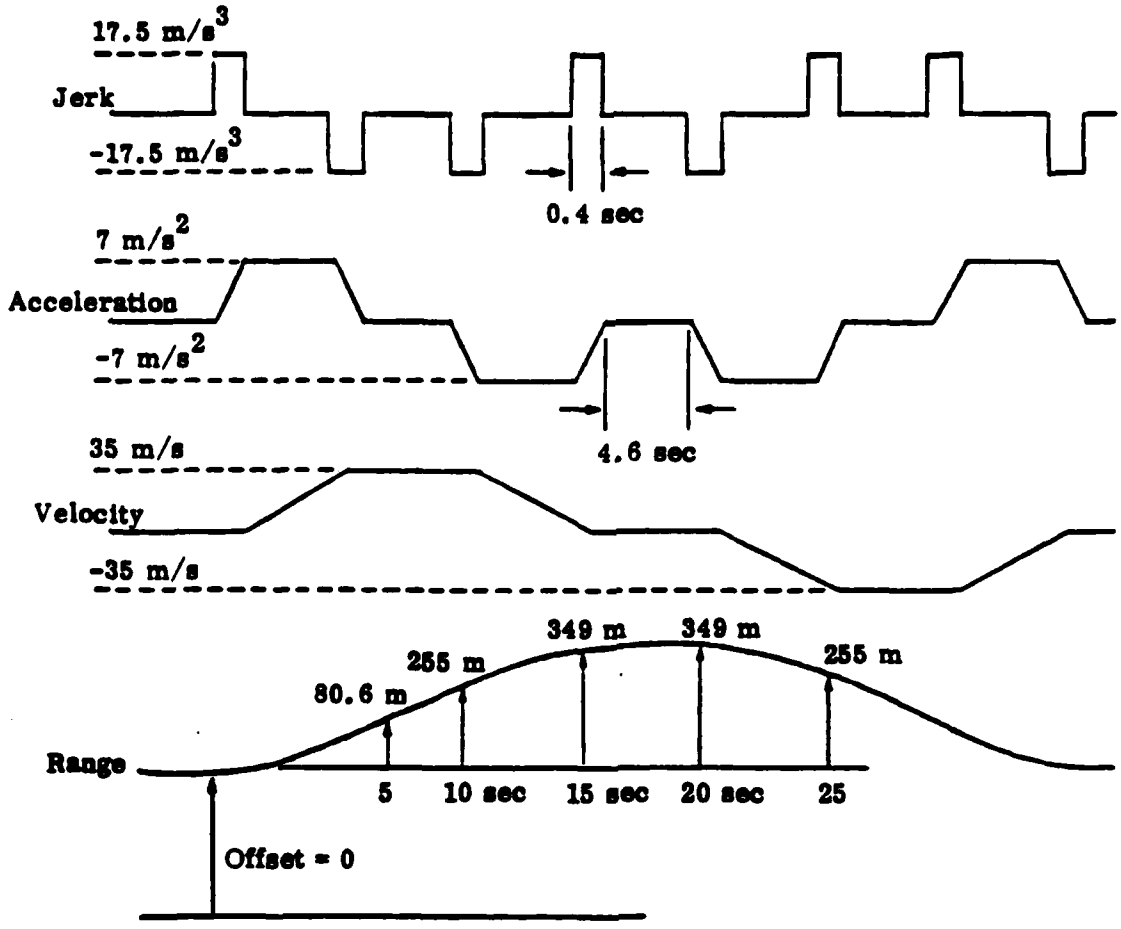
	Output Name	Output Level	Equipment Used
1.	Reacquisition Time	TBD	TBD
2.			
3.			
4.			
5.			

Test Procedure: Inject signal from Satellite Signal Generator into receiver front end (SSG signal for each test will be a combination of GPS and jamming signals, altered as necessary to simulate host vehicle dynamics, at the levels shown on page one for each test). Receiver shall operate in substate 5 of state 7 for each test. When all channels are tracking signal, receiver shall be turned off for 10 seconds and then back on again. Measure and record reacquisition time for each channel.

Data Reduction: Input levels and conditions, and reacquisition times will be recorded.

Equipment List:

1.	SSG	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	



10-sec signal outage is asynchronous with dynamic profile.

Note: Dynamic factors exceed one sigma values of SS-US-200, Table XI-V, so that the range offset achieved during signal outage will be consistent with the required statistical position uncertainty.

Dynamic Profile — Five Channel Receiver Reacquisition Test
(State 5 Track)

Contractor: Magnavox/Collins

Board Tested: Standard Receiver Tests 21-22

Test Objective: To determine receiver ability to measure ionospheric delay (Test 21 for 5 channel set. Test 22 for all other sets).

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz (21, 22)	1227.6MHz @ -163dBw	Satellite Signal Generator
2.	1227.6MHz (21, 22)	1575.42MHz @ -166dBw	Satellite Signal Generator
3.	P Code (21, 22)	TBD	Satellite Signal Generator
4.	GPS Data (21, 22)	TBD	Satellite Signal Generator
5.	CW Jammer	GPS freq. @ -126dBw to -122dBw	Satellite Signal Generator
6.	Dynamic Profile Attached	TBD	Satellite Signal Generator
7.			
8.			
9.			
10.			
11.			
12.			

Outputs

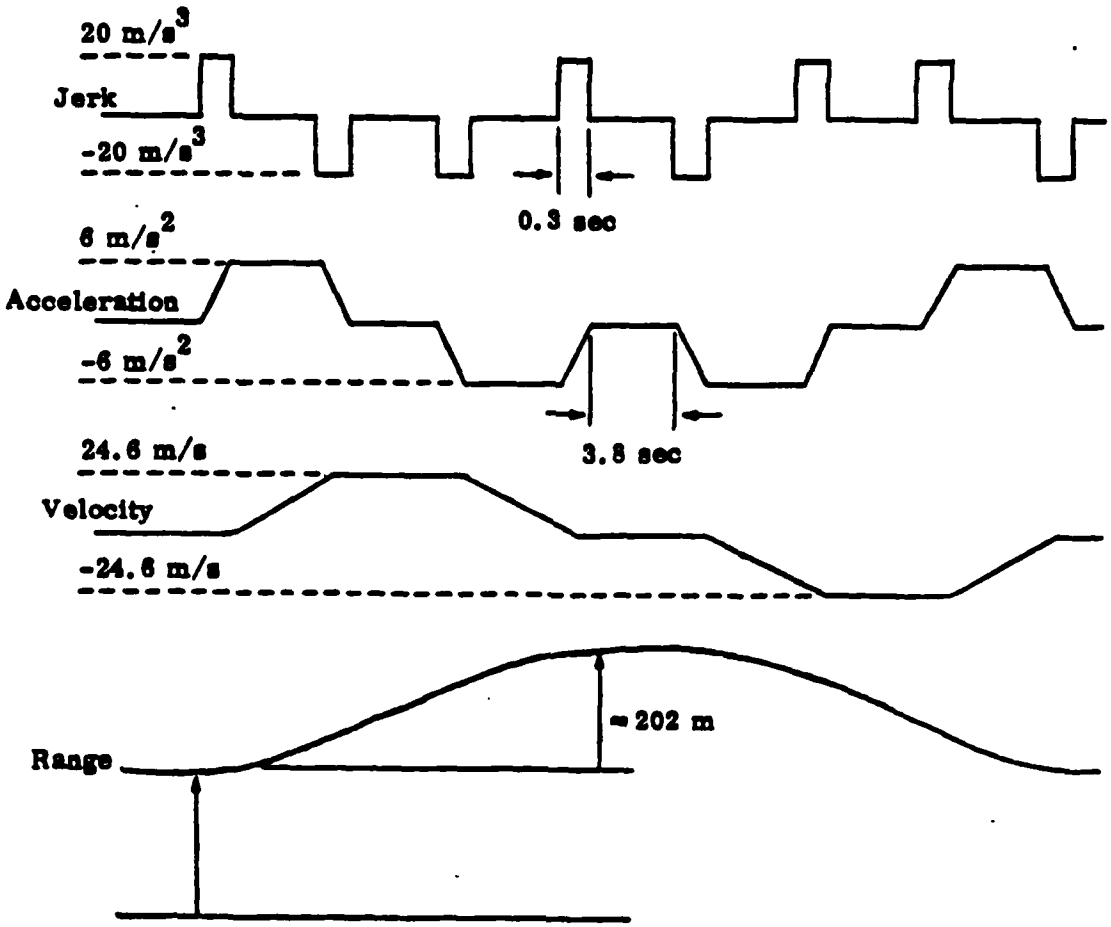
	Output Name	Output Level	Equipment Used
1.	Ionospheric Delay	TBD	TBD
2.			
3.			
4.			
5.			

Test Procedure: Inject signal from Satellite Signal Generator into receiver front end (SSG signal for each test will be a combination of GPS and jamming signals, altered as necessary to simulate host vehicle dynamics, at the levels shown on page one for each test). Delays will be set at +100, +50, 0-50, and -200 nsec. Continuous tracking receivers will operate in State 5, sequentially tracking receivers shall operate in substate 5 of State 6. Ionospheric delays will be measured.

Data Reduction: Measured delays will be compared with known delays and both will be recorded. Input levels and conditions will also be recorded.

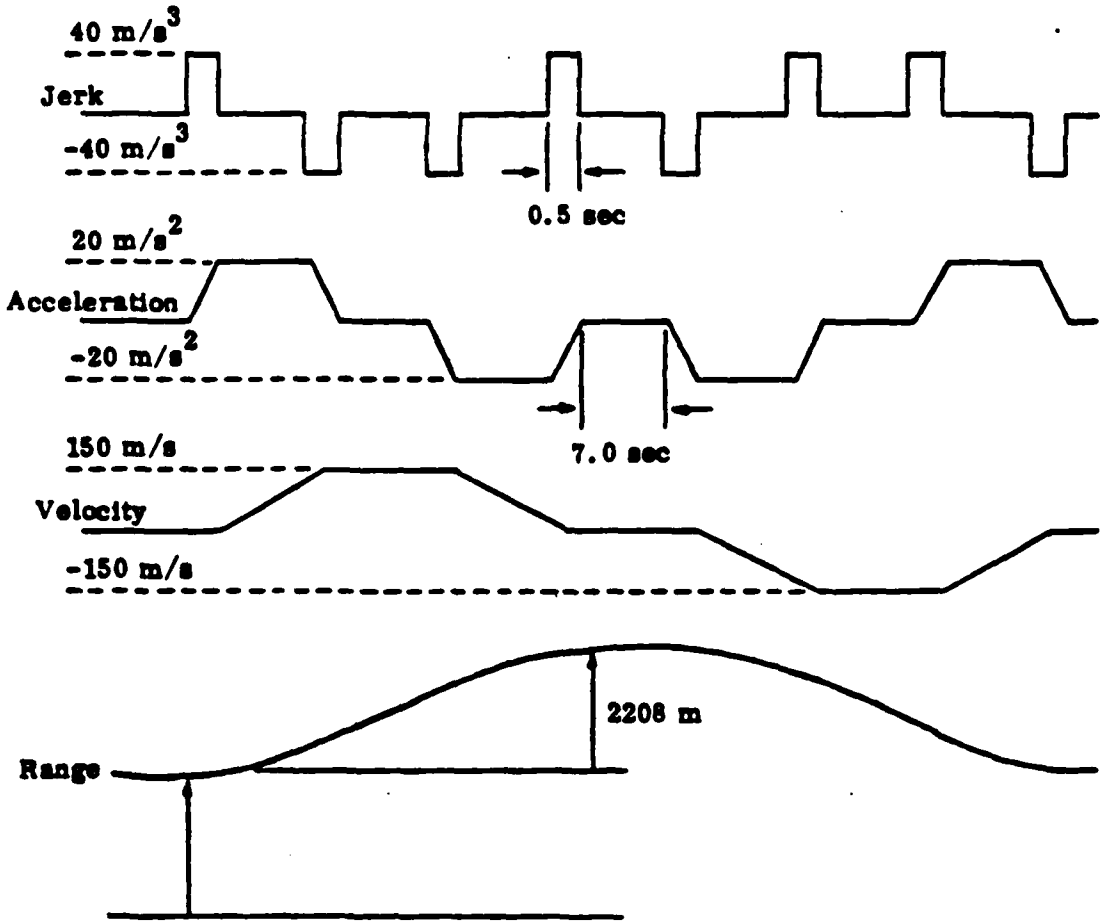
Equipment List:

1.	SSG	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	



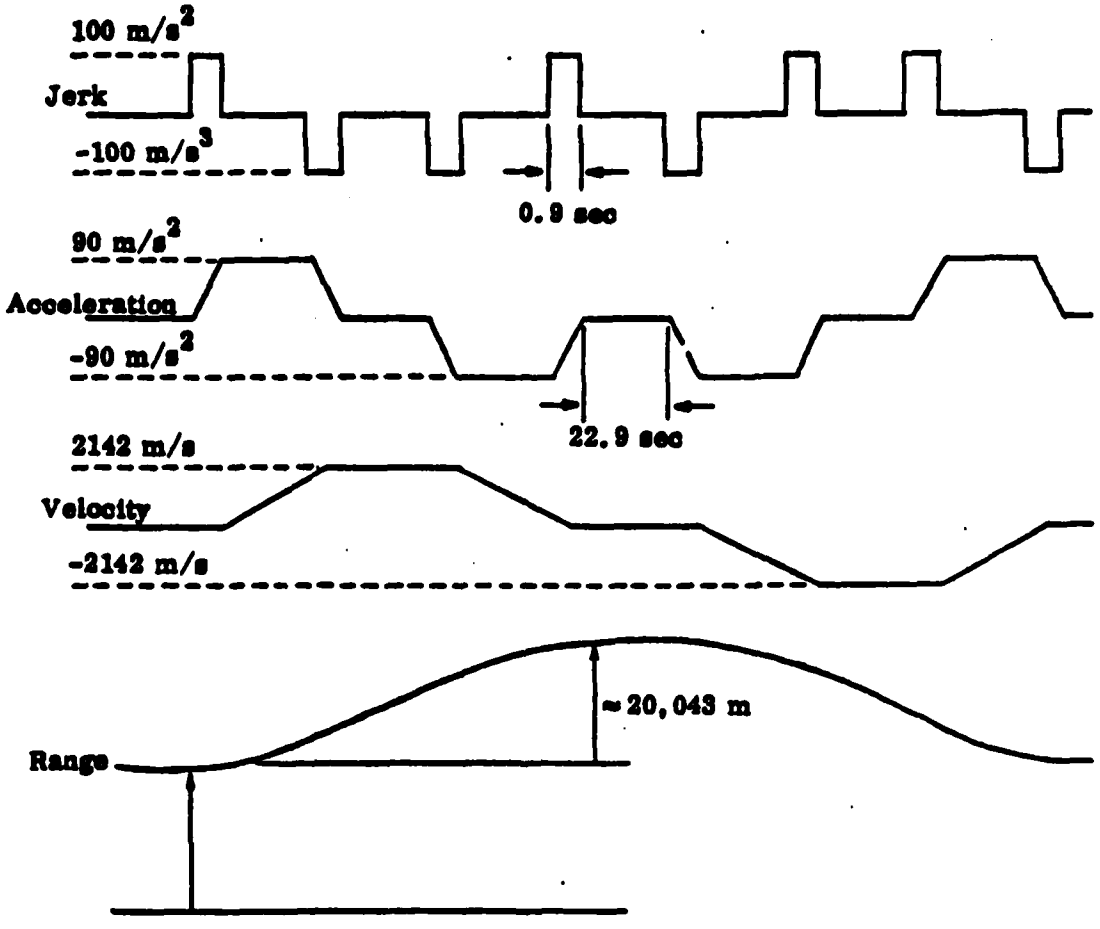
Note: Jerk from SS-US-200, Table II, Category A
Acceleration from SS-US-200, Table I-IV
Velocity from SS-US-200, Table I-IV

Dynamic Profile — One channel receiver Ionospheric Delay tests.



Note: Jerk from SS-US-200, Table II-IV
Accleration from SS-US-200, 20.3.2.1.11
Velocity from SS-US-200, Table II-V

Dynamic Profile — Two channel reciever Ionospheric Delay tests



Note: Jerk from SS-US-200, 40.3.2.1.11
Acceleration from SS-US-200, 40.3.2.1.11
Velocity from SS-US-200, Table IV-IV, plus SV max velocity of 940 m/s

Dynamic Profile — Five channel receiver Ionospheric Delay tests

Contractor: Magnavox/Collins

Board Tested: Standard Receiver Tests 23-24

Test Objective: Measure receiver calibration repeatability in eliminating channel to channel pseudo range biases (2 and 5 channel sets only).

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz (23)	1227.6MHz @ -163dBw	Satellite Signal Generator
2.	1227.6MHz (24)	1575.42MHz @ -163dBw	Satellite Signal Generator
3.	P Code (23, 24)	TBD	Satellite Signal Generator
4.	* Dynamics (HV)	TBD	Satellite Signal Generator
5.	GPS Data (23, 24)	TBD	Satellite Signal Generator
6.			
7.			
8.			
9.			
10.			
11.			
12.			

* Dynamics will be constant 900m/sec velocity.

Outputs

	Output Name	Output Level	Equipment Used
1.	Pseudo Range	TBD	TBD
2.			
3.			
4.			
5.			

Test Procedure: Inject signal from Satellite Signal Generator into receiver front end (SSG signal for each test will be a combination of GPS and jamming signals, altered as necessary to simulate host vehicle dynamics, at the levels shown on page one for each test). Receiver shall be operating in State 5 (5 channel sets) or State 6 substate 5 (2 channel sets). Pseudo range will be measured for each channel.

Data Reduction: Pseudo ranges for each channel will be compared to determine channel to channel bias. Data and input levels and conditions will be recorded.

Equipment List:

1.	SSG	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	

Contractor: Magnavox/Collins

Board Tested: Standard Receiver Tests 25-28

Test Objective: Measure the ability of receiver to demodulate 50 bps navigation data under various conditions.

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz (25, 26)	1227.6MHz @ -163dBw	Satellite Signal Generator
2.	1227.6MHz (27, 28)	1575.42MHz @ -163dBw	Satellite Signal Generator
3.	C/A Code (26, 28)	TBD	Satellite Signal Generator
4.	P Code (25, 27)	TBD	Satellite Signal Generator
5.	GPS Data (25-28)	TBD	Satellite Signal Generator
6.	CW Jammer (25, 27)	GPS freq. @ -122dBw	Satellite Signal Generator
7.	Noise Mod. Jammer (26)	1227.6MHz @ -132dBw (100kHz BW)	Satellite Signal Generator
8.	Noise Mod. Jammer (28)	1575.42MHz @ -132dBw (2MHz BW)	Satellite Signal Generator
9.	Dynamic Profiles Attached	TBD	Satellite Signal Generator
10.			
11.			
12.			

Outputs

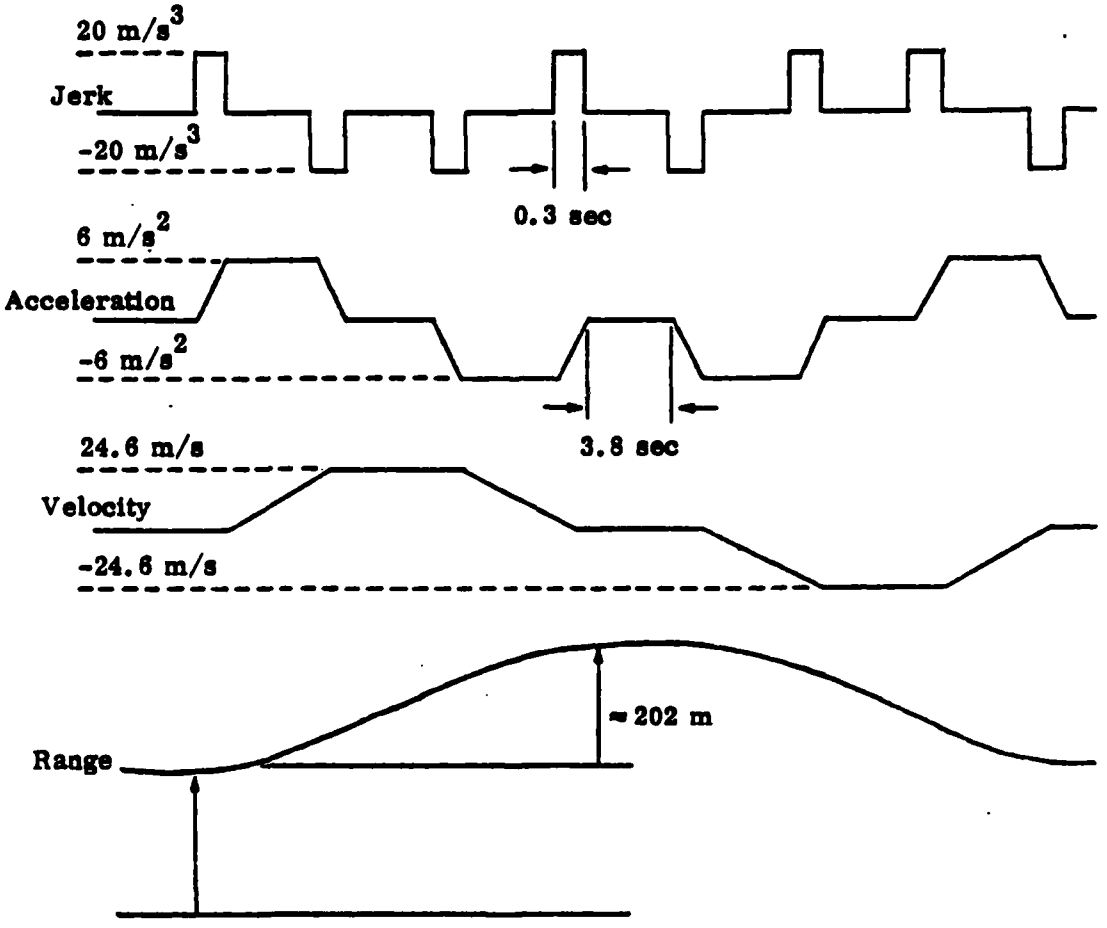
	Output Name	Output Level	Equipment Used
1.	UBER	TBD	TBD
2.			
3.			
4.			
5.			

Test Procedure: Inject signal from Satellite Signal Generator into receiver front end (SSG signal for each test will be a combination of GPS and jamming signals, altered as necessary to simulate host vehicle dynamics, at the levels shown on page one for each test). Receiver shall be operating in State 5. UBER will be recorded. Repeat test for receiver operating in Substate 5 of State 6.

Data Reduction: Undetected BIT Error Rate (UBER) will be recorded. Input levels and conditions will be recorded also.

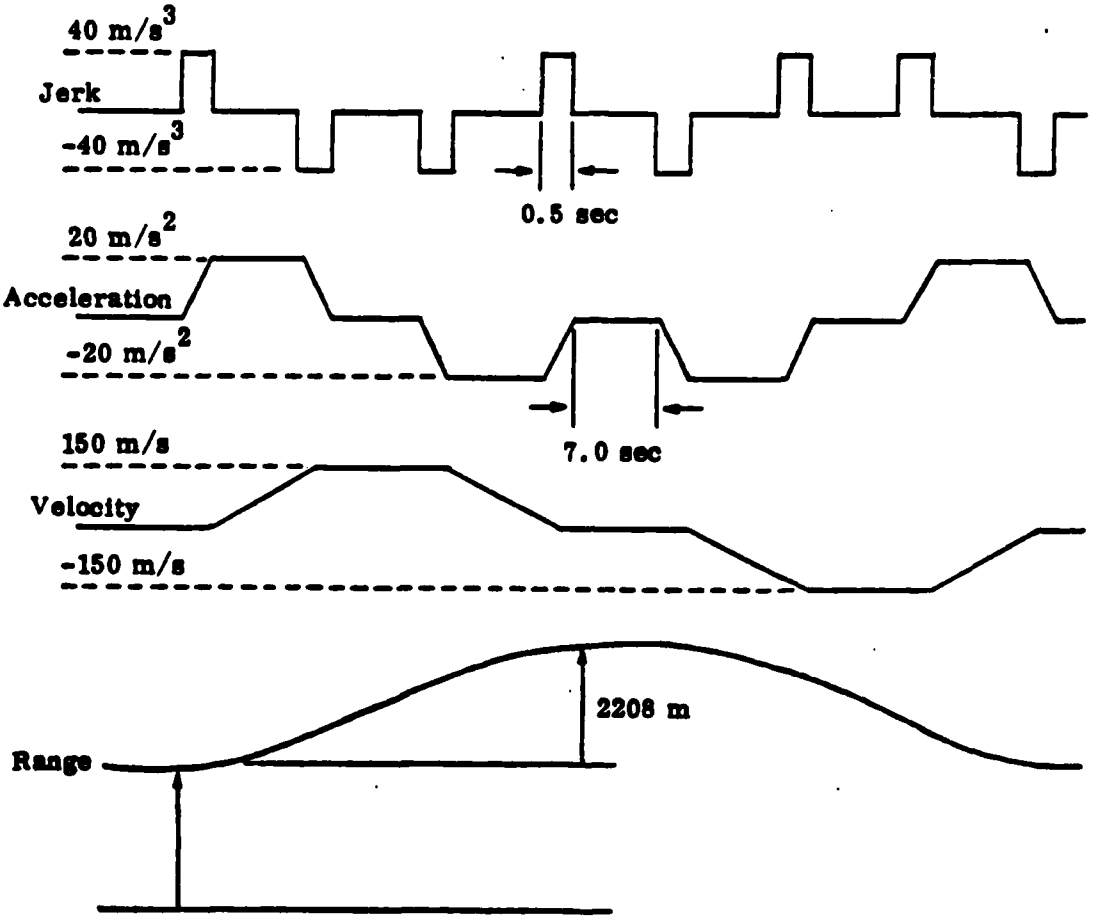
Equipment List:

1.	SSG	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	



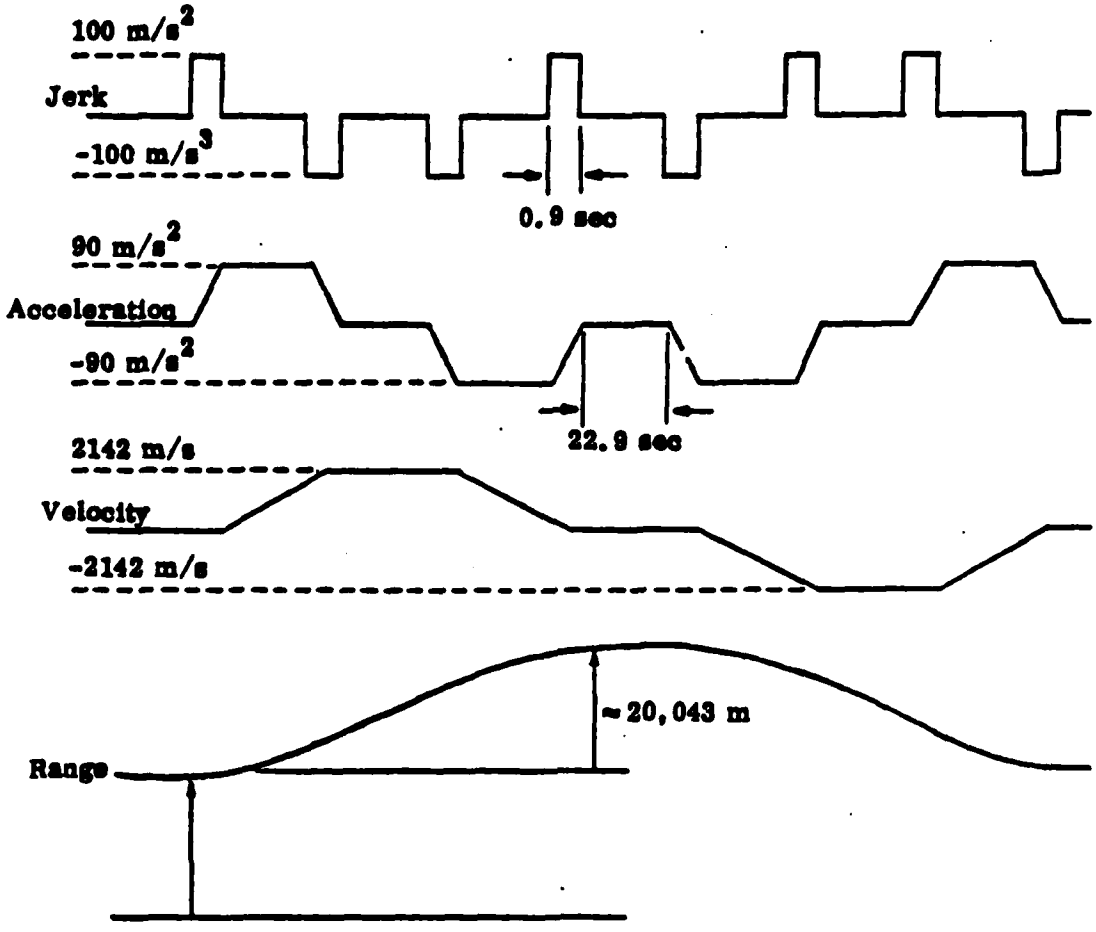
Note: Jerk from SS-US-200, Table II, Category A
Accleration from SS-US-200, Table I-IV
Velocity from SS-US-200, Table I-IV

Dynamic Profile — One Channel Receiver Sequencing Tests



Note: Jerk from SS-US-200, Table II-IV
Accleration from SS-US-200, 20.3.2.1.11
Velocity from SS-US-200, Table II-V

Dynamic Profile — Two Channel Receiver Sequencing Tests



Note: Jerk from SS-US-200, 40.3.2.1.11
Acceleration from SS-US-200, 40.3.2.1.11
Velocity from SS-US-200, Table IV-IV, plus SV max velocity of 940 m/s

Dynamic Profile — Five Channel Receiver Tracking Tests

Contractor: Magnavox/Collins

Board Tested: Standard Receiver Tests (29-30)

Test Objective: Measure ability of receiver to estimate C/No level for various conditions.

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz (29)	1227.6MHz @ various levels	Satellite Signal Generator
2.	1227.6MHz (30)	1575.42MHz @ various levels	Satellite Signal Generator
3.	C/A Code (30)	TBD	Satellite Signal Generator
4.	P Code (29)	TBD	Satellite Signal Generator
5.	GPS Data (29-30)	TBD	Satellite Signal Generator
6.	CW Jammer (29)	1227.6MHz @ various levels	Satellite Signal Generator
7.	Noise Mod. Jammer (30)	1575.42MHz @ various levels (10MHz BW)	Satellite Signal Generator
8.	Dynamic Profiles Attached	TBD	Satellite Signal Generator
9.			
10.			
11.			
12.			

Outputs

	Output Name	Output Level	Equipment Used
1.	C/No	TBD	TBD
2.			
3.			
4.			
5.			

Test Procedure: Inject signal from Satellite Signal Generator into receiver front end (SSG signal for each test will be a combination of GPS and jamming signals, altered as necessary to simulate host vehicle dynamics, at the levels shown on page one for each test). C/No test levels are attached. Tests shall be conducted for receiver operating in State 5 and in Substate 5 of State 6. C/No measurements will be recorded for various levels of signal and jammer power.

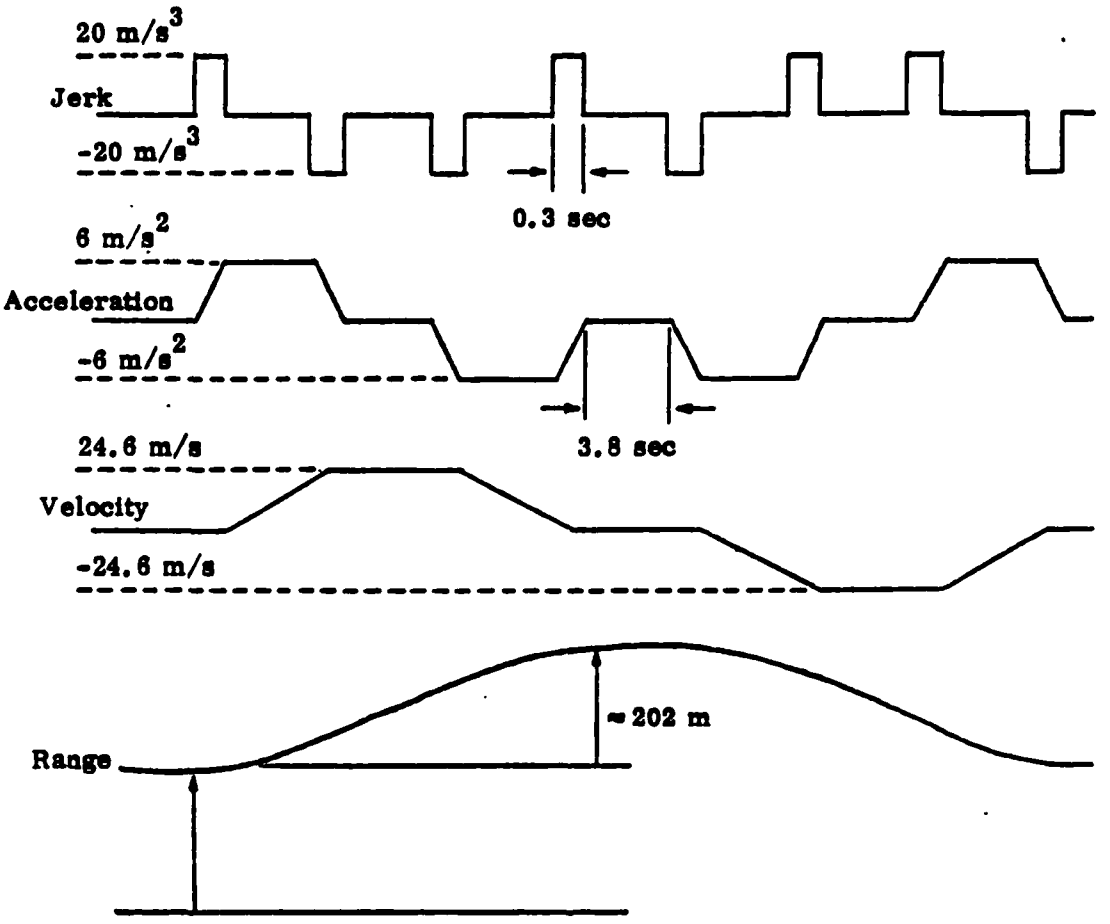
Data Reduction: Measured C/No will be compared with theoretical value and recorded. Input levels and conditions will be recorded also.

Equipment List:

1.	SSG	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	

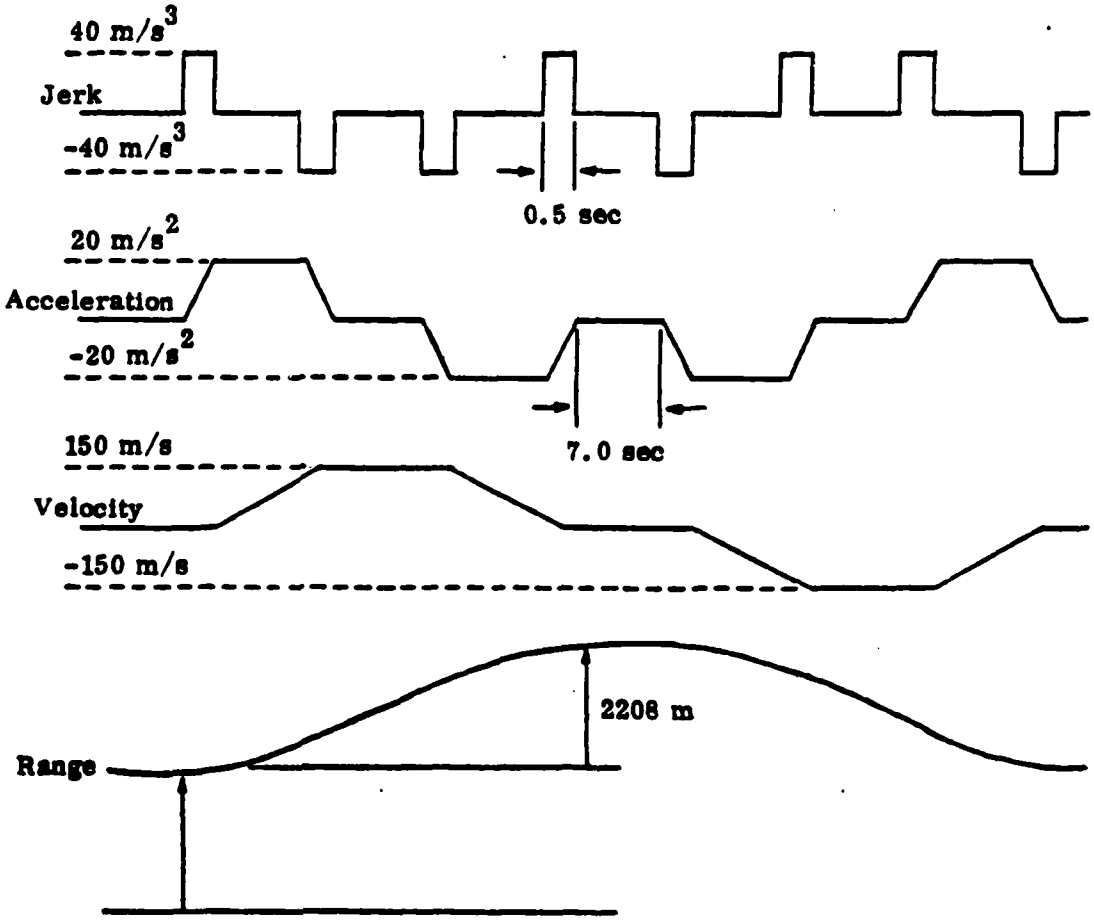
C/N_0 TEST LEVELS

Signal Power Referenced to Preamp Input (dBW)	L_1 (P) J/S (dB)	L_2 (C/A) J/S (dB)
1. -150	0	0
2. -156	0	0
3. -163	0	0
4. -163	30	20
5. -163	35	25
6. -163	40	30



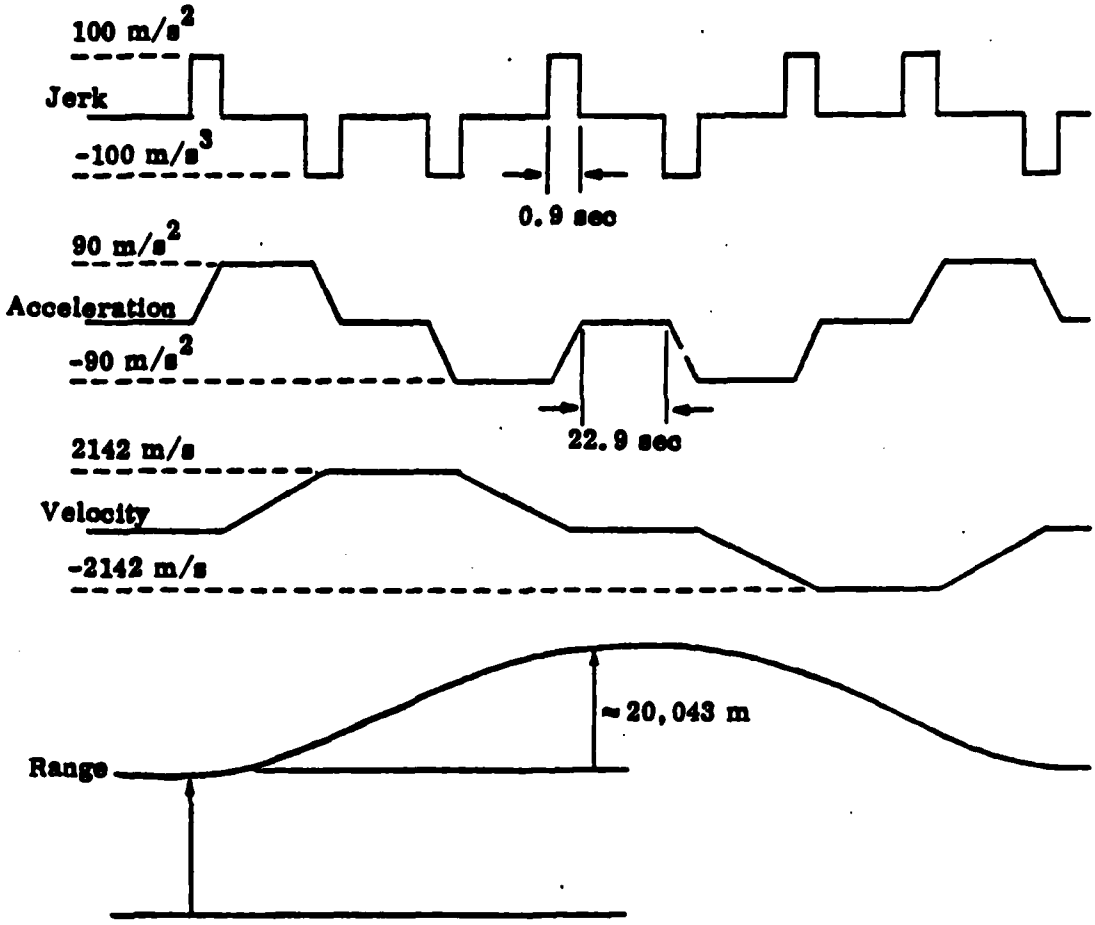
Note: Jerk from SS-US-200, Table II, Category A
Acceleration from SS-US-200, Table I-IV
Velocity from SS-US-200, Table I-IV

Dynamic Profile — One Channel Receiver Sequencing Tests



Note: Jerk from SS-US-200, Table II-IV
Accleration from SS-US-200, 20.3.2.1.11
Velocity from SS-US-200, Table II-V

Dynamic Profile — Two Channel Receiver Sequencing Tests



Note: Jerk from SS-US-200, 40.3.2.1.11
Acceleration from SS-US-200, 40.3.2.1.11
Velocity from SS-US-200, Table IV-IV, plus SV max velocity of 940 m/s

Dynamic Profile — Five Channel Receiver Tracking Tests

Contractor: Magnavox/Collins

Board Tested: Receiver

Test Objective: To test receiver operation under various conditions of multipath propagation.

Inputs

	Input Name	Input Level	Equipment Used
1.	1575.42MHz	1227.6MHz @ -163dBw	Satellite Signal Generator
2.	1227.6MHz	1575.42MHz @ -163dBw	Satellite Signal Generator
3.	P Code	TBD	Satellite Signal Generator
4.	C/A Code	TBD	Satellite Signal Generator
5.	GPS Data	TBD	Satellite Signal Generator
6.			
7.			
8.			
9.			
10.			
11.			
12.			

Outputs

	Output Name	Output Level	Equipment Used
1.	DR	TBD	TBD
2.	PR	TBD	TBD
3.			
4.			
5.			

Test Procedure: Inject GPS signa. [illegible] from Satellite Sig al Generator [illegible] ceiver operation and ability to [illegible] determine proper delta range an[illegible] data. Perform this test for [illegible] with various amounts of delay.

Data Reduction: Input [illegible] ceiver measurements of [illegible] with "truth" values.

Equipment List:

1.	SSG	4.		7.	
2.	TBD	5.		8.	
3.		6.		9.	

3.2 ANTENNA TEST REQUIREMENTS

This section contains the antenna test requirements for the Fixed Reception Pattern Antenna (FRPA) and the Controlled Reception Pattern Antenna (CRPA) for both Magnavox and Rockwell-Collins. Most of the antenna tests will be performed in the Anechoic Chamber. This section is limited to the bench tests that will be performed on the antenna.

3.2.1 Antenna Test Procedures

The following sheets contain the initial test requirements and procedures as listed in Section 1.1 for both Magnavox and Rockwell-Collins antennas. These sheets will be refined and new sheets will be added as more information becomes available.

3.2.1.1 COLLINS/MAGNAVOX ANTENNA BENCH TEST PROCEDURES AND BLOCK DIAGRAMS

Contractor: Collins/Magnavox

Board Tested: FRPA Antenna

Test Objective: Measure aperature VSWR of Fixed Reception Pattern Antenna.

Inputs

	Input Name	Input Level	Equipment Used
1.	S-Par Test Set	L1 (1575 ± 10MHz) @ TBD	Sweep Generator (HP-8340A)
2.	S-Par Test Set	L2 (1228 ± 10MHz) @ TBD	Sweep Generator (HP-8340A)
3.	S-Par Test Set	1070 to 1735 @ TBD	Sweep Generator (HP-8340A)
4.			Microwave Ctr. (HP-5342A)
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

Outputs

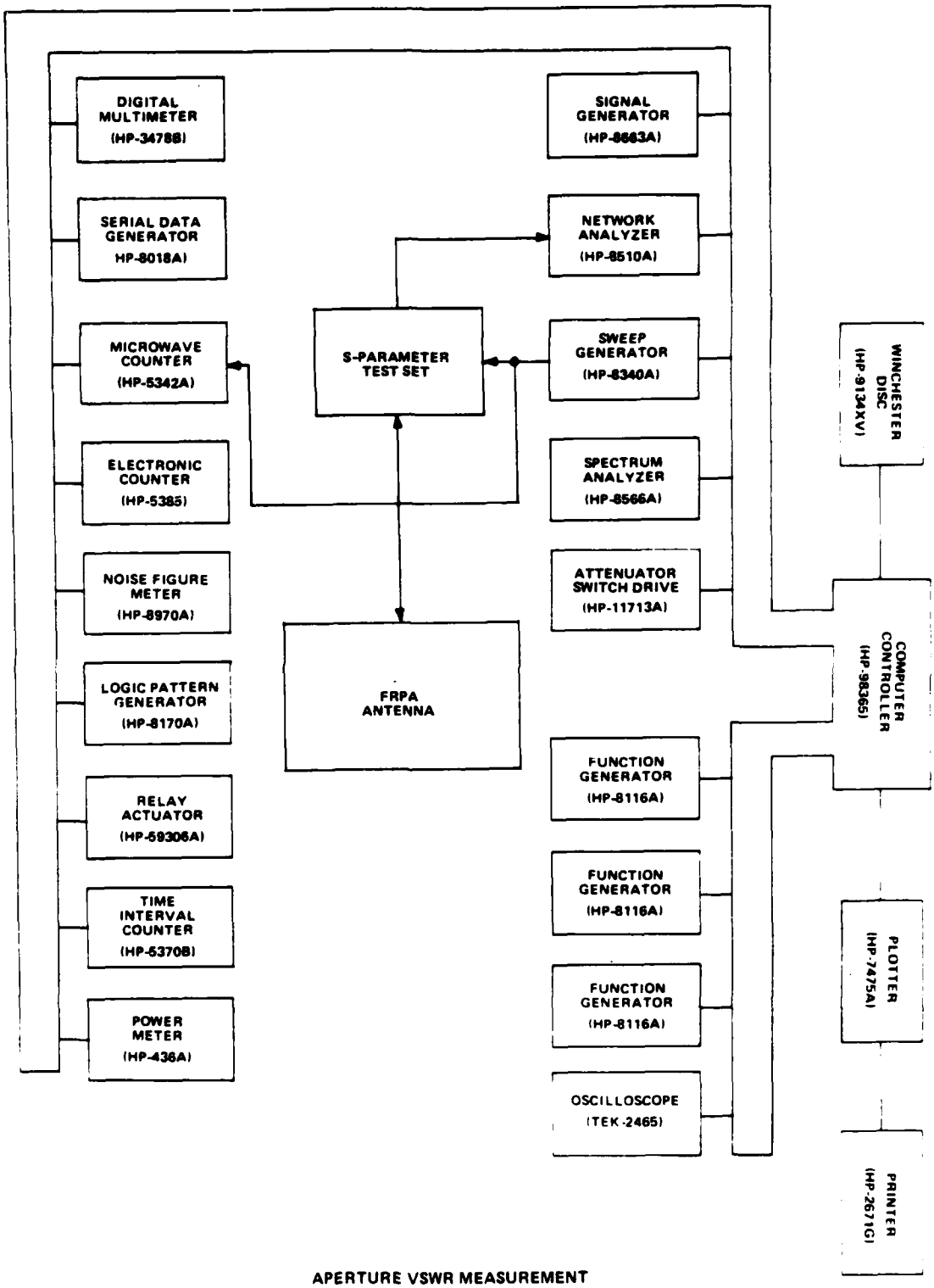
	Output Name	Output Level	Equipment Used
1.	FRPA Input (L1)	1.5:1	S-Par Test Set (HP-8515A)
2.	FRPA Input (L2)	1.5:1	Network Analyzer (HP-8510A)
3.	FRPA Input (range)	2.0:1	
4.			
5.			

Test Procedure: Turn on test equipment. Set measurement equipment to proper ranges. Set Sweep Generator to sweep through frequency range with markers at L1 and L2. Measure VSWR with Network Analyzer.

Data Reduction: Send input levels to printer. Output data from Network Analyzer will be plotted on a Smith Chart.

Equipment List:

1.	Computer (HP-9836S)	4.	Sweep Gen. (HP-8340A)	7.	Network Anal. (HP-8510A)
2.	Printer (HP-2671G)	5.	Microwave Ctr (HP-5342A)	8.	
3.	Plotter (HP-7475A)	6.	S-Par Test Set (HP-8515A)	9.	



APERTURE VSWR MEASUREMENT

Contractor: Collins/Magnavox

Board Tested: CRPA Antenna

Test Objective: Measure aperature VSWR of Controlled Reception Pattern Antenna.

Inputs

	Input Name	Input Level	Equipment Used
1.	S-Par Test Set	L1 (1575 ± 10MHz) @ TBD	Sweep Generator (HP-8340A)
2.	S-Par Test Set	L2 (1227 ± 10MHz) @ TBD	Sweep Generator (HP-8340A)
3.	S-Par Test Set	1070-1735MHz @ TBD	Sweep Generator (HP-8340A)
4.			Microwave Ctr. (HP-5342A)
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

Outputs

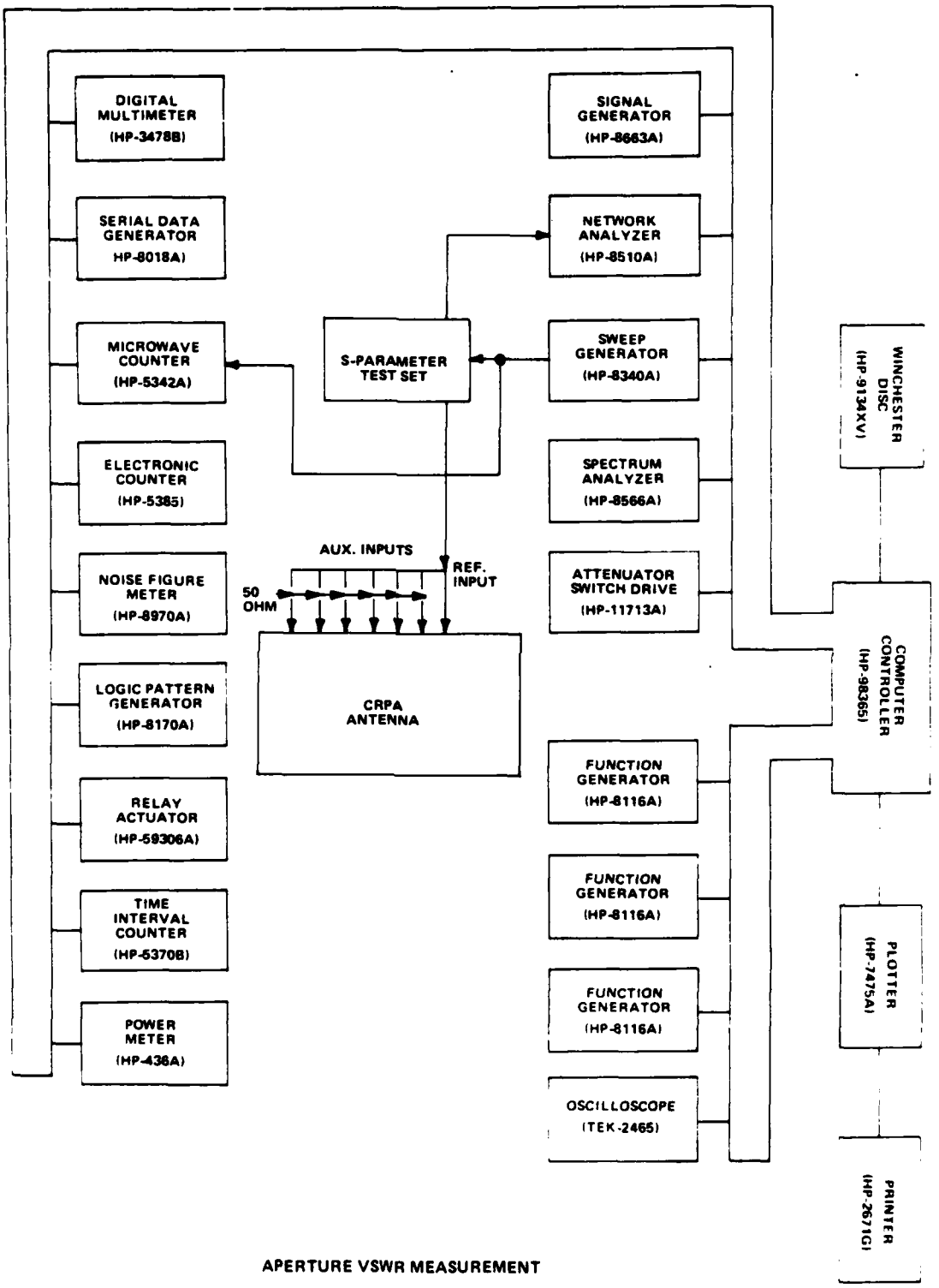
	Output Name	Output Level	Equipment Used
1.	Reference Input (L1)	1.5:1	S-Par Test Set (HP-8515A)
2.	Reference Input (L2)	1.5:1	Network Analyzer (HP-8510A)
3.	Auxiliary Inputs (L1)	3.0:1	
4.	Auxiliary Inputs (L2)	3.0:1	
5.	Aux. Inputs (entire range)	5.0:1	

Test Procedure: Turn on test equipment. Set measurement equipment to proper ranges. Set Sweep Generator to sweep L1. Measure VSWR vs. frequency of Reference Channel and Auxiliary Channel Inputs. Repeat for L2.

Data Reduction: Send input levels to printer. Output data from Network Analyzer will be plotted on a Smith Chart.

Equipment List:

1.	Computer (HP-9836S)	4.	Sweep Gen. (HP-8340A)	7.	Network Anal. (HP-8510A)
2.	Printer (HP-2671G)	5.	Microwave Ctr. (HP-5342A)	8.	
3.	Plotter (HP-7475A)	6.	S-Par. Test Set (HP-8515A)	9.	



APERTURE VSWR MEASUREMENT

Contractor: Collins/Magnavox

Board Tested: FRPA Antenna

Test Objective: Continuity Test for Fixed Reception Pattern Antenna.

Inputs

	Input Name	Input Level	Equipment Used
1.	Inner Conductor	----	Digital Multi. (HP-3478B)
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

Outputs

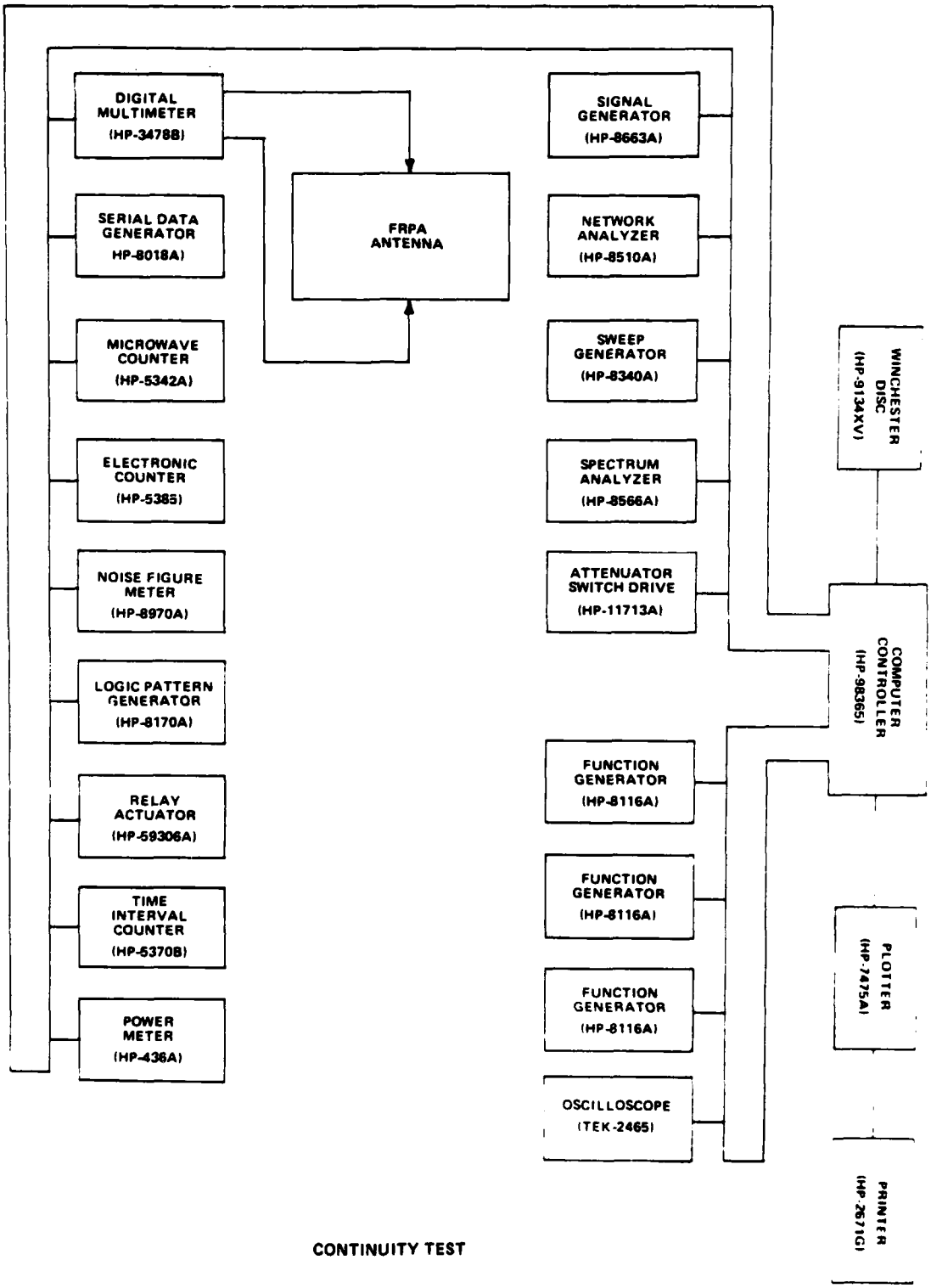
	Output Name	Output Level	Equipment Used
1.	Outer Conductor	TBD	Digital Multi. (HP-3478B)
2.			
3.			
4.			
5.			

Test Procedure: Turn on test equipment. Set measurement equipment to proper ranges. Short meter leads together and adjust zero. Attach one lead to the inner conductor of each of the test connector(s) and the other lead to the outer conductor of the antenna. If the meter deflects, there is DC Continuity between inner conductor and antenna base (outer conductor).

Data Reduction: Send data from Digital Multimeter to printer.

Equipment List:

1.	Computer (HP-9836S)	4.		7.	
2.	Printer (HP-2671G)	5.		8.	
3.	Digital Multi. (HP-3478B)	6.		9.	



CONTINUITY TEST

Contractor: Collins/Magnavox

Board Tested: CRPA Antenna

Test Objective: Continuity test for Controlled Reception Pattern Antenna.

Inputs

	Input Name	Input Level	Equipment Used
1.	Inner Conductor	----	Digital Multi. (HP-3478B)
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

Outputs

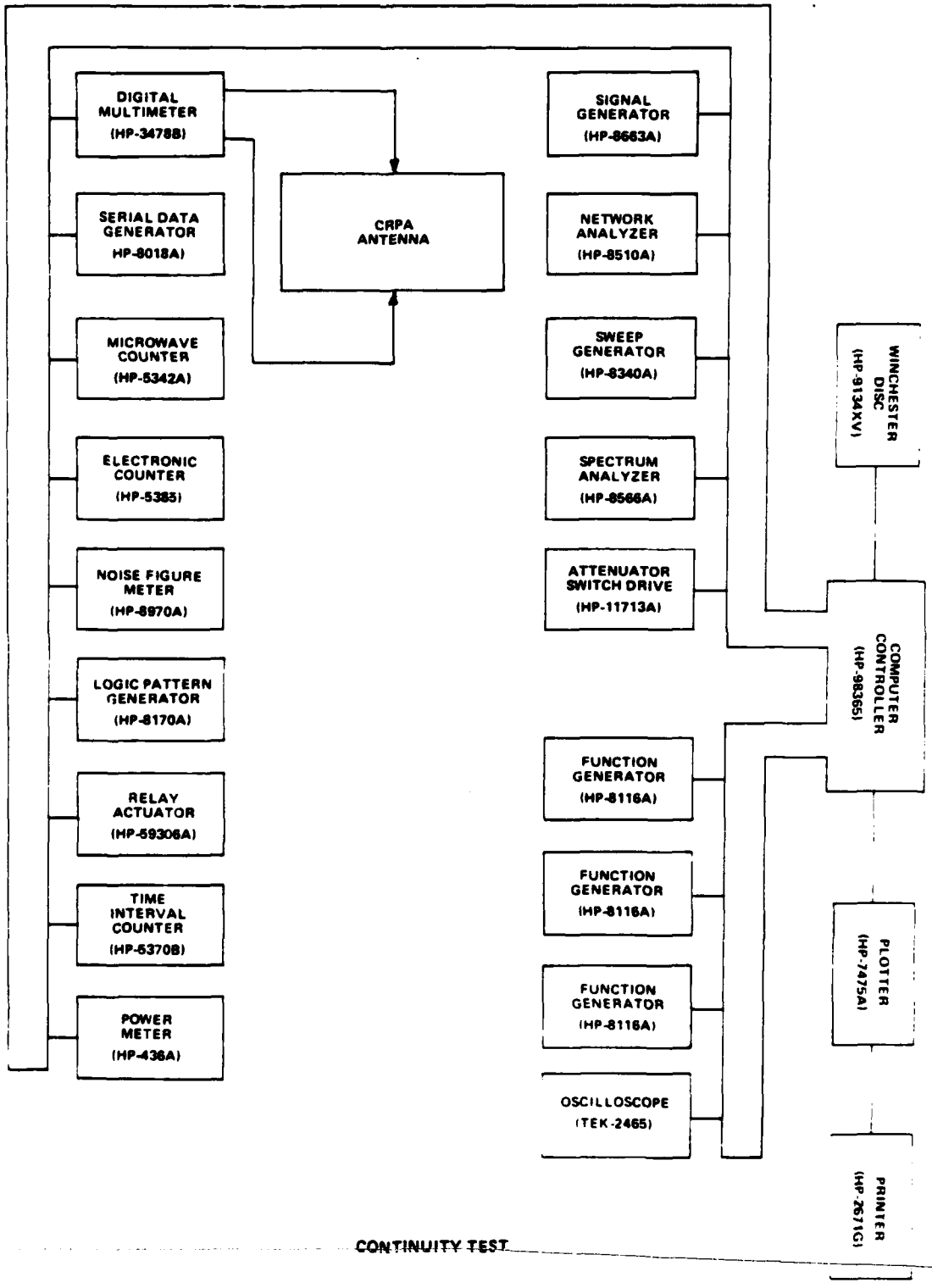
	Output Name	Output Level	Equipment Used
1.	Outer Conductor	TBD	Digital Multi. (HP-3478B)
2.			
3.			
4.			
5.			

Test Procedure: Turn on test equipment. Set measurement equipment to proper ranges. Short meter leads together and adjust zero. Attach one lead to the inner conductor of each of the Test Connector(s) and the other lead to the Outer Conductor of the antenna. If the meter deflects, there is DC Continuity between Inner Conductor and Antenna Base (Outer Conductor).

Data Reduction: Output data from Digital Multimeter to printer.

Equipment List:

1.	Computer (HP-9836S)	4.		7.	
2.	Printer (HP-2671G)	5.		8.	
3.	Digital Multi. (HP-3478B)	6.		9.	



CONTINUITY TEST

4.0 SOFTWARE REQUIREMENTS

This sections contains the software requirements for the Antenna bench test procedures defined in Section 3.2. These software requirements are defined in terms of flowcharts.

The software requirements contained herein are written at the functional level. There is a flowchart for each test procedure that illustrates the sequence of events that will be required in order to perform these tests by computer. In addition to these requirements, all tests will include the following capabilities:

- menu driven testing will prompt operator through:
    1. test set-ups
    2. testing
    3. data reduction/storage/hardcopy
- Each test will have a program module number and will be contained in a testing menu. All tests with the same set-ups can be grouped together to be run one after the other.
- Each test will incorporate a full error-checking capability during operator inputs so that no manual error can be entered into the system.
- Data reduction based on baseline data and/or range limits. The specified range values and/or tolerance will be stored and compared to the results obtained from the actual test. The values will be displayed and any differences can quickly be seen.
- There will be real-time monitoring for any bus available information during testing.
- There will be off-line storage or transfer of data for interfacing with the DPSSF/NSL system capabilities. This capability will be used for any information that is needed for the DPSSF, NSL or for RFL data reduction requirements.

- All software will be stored including back-up disks and hardcopy listings in a library which will contain as a minimum the following information in its catalog:
  1. program module name and number (disk #)
  2. back-up copy # (disk #)
  3. date written, by whom
  4. date last revised, by whom

There are two floppy disk drives which have a memory of 170k each built into the computer. All information will be stored on either of these floppy disks. There is also a Winchester hard disk provided. This can be used as a temporary storage for data and information obtained while testing, if needed. For example, if a series of tests are being run and many data points are needed to be stored and all of the memory is being used in the computer, this information is stored temporarily on the Winchester disk until processing is complete and then archived onto the floppy disks.

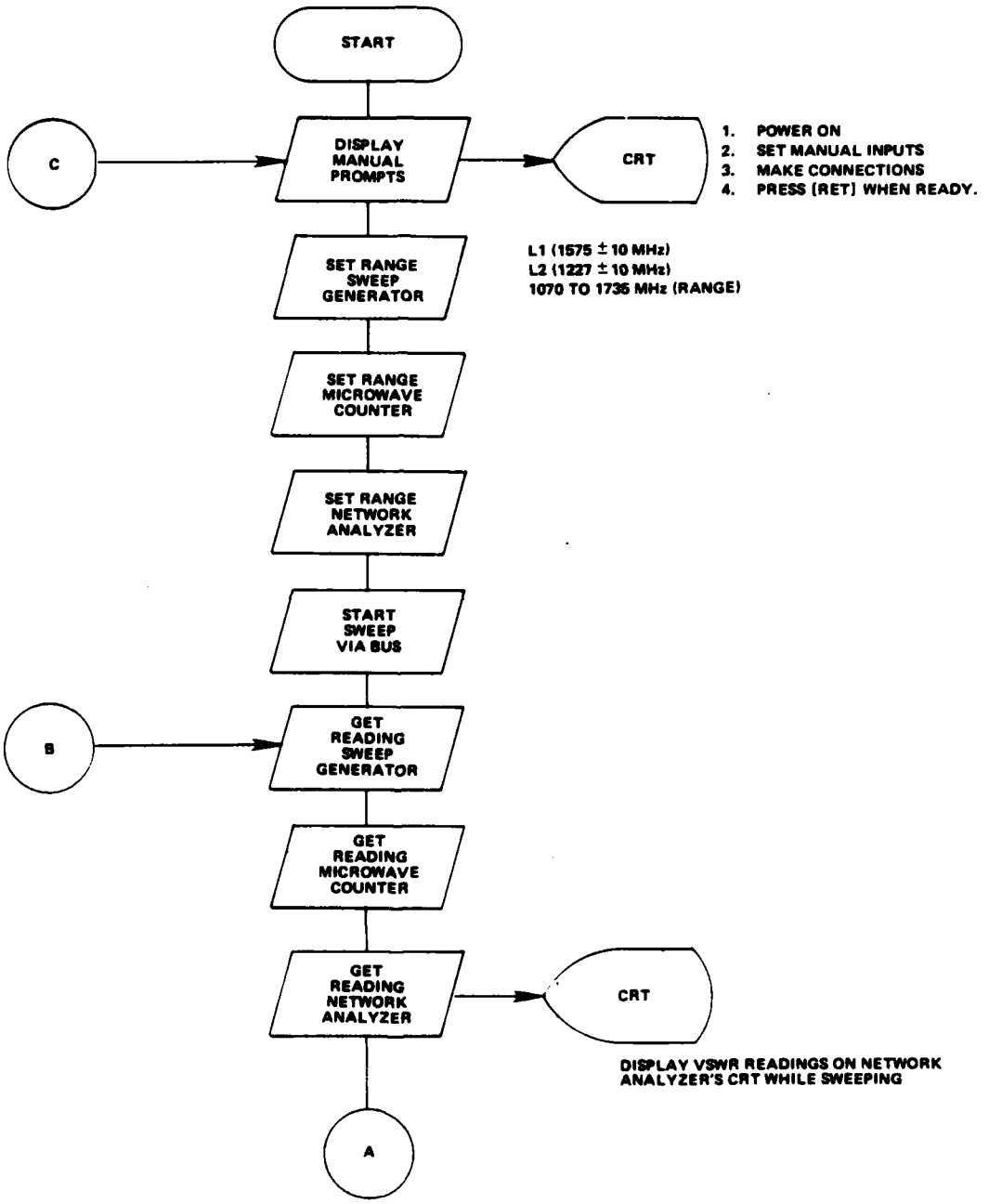
4.1 ANTENNA SOFTWARE REQUIREMENTS

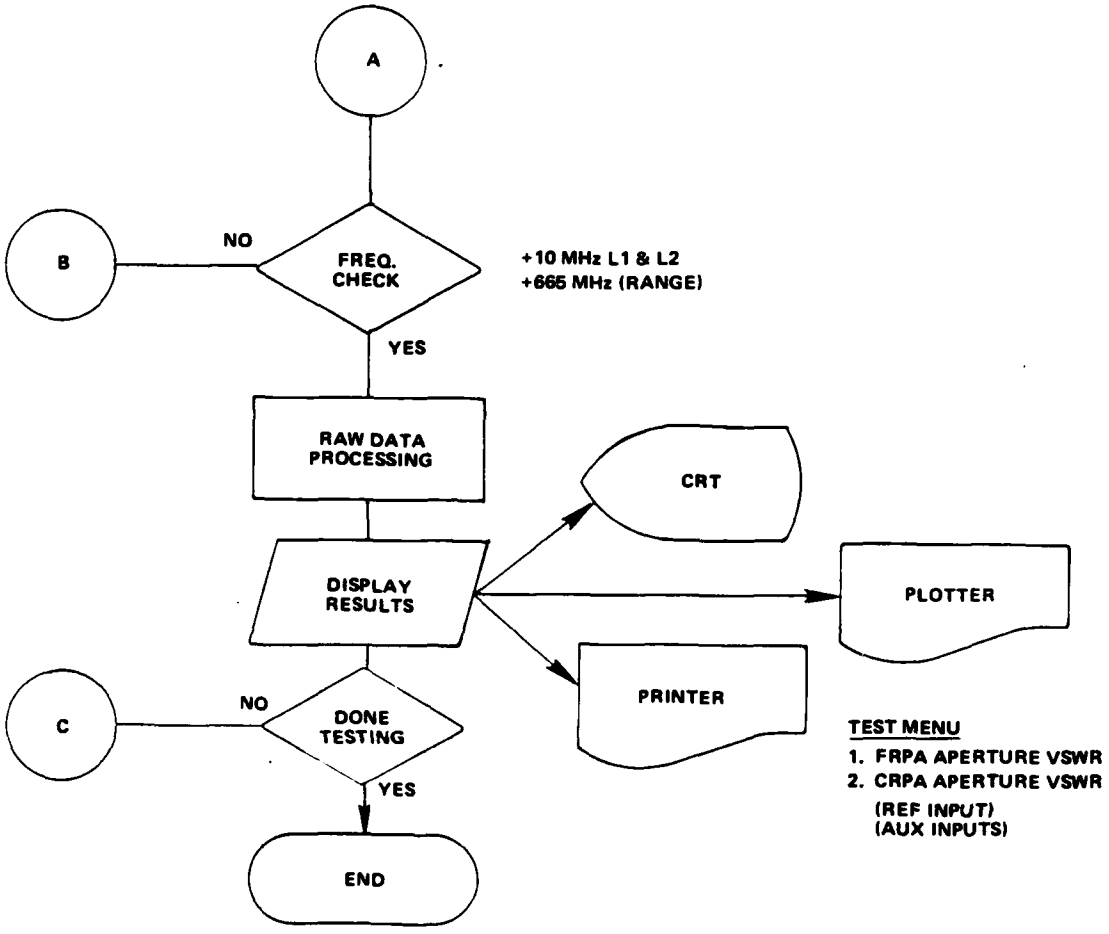
The following sheets contain the software requirements for the Antenna bench test procedures defined in Section 3.2. These software requirements will also be refined and expanded as more detailed information becomes available for the bench tests.

4.1.1 ROCKWELL-COLLINS/MAGNAVOX ANTENNA SOFTWARE REQUIREMENTS

APERTURE VSWR MEASUREMENT

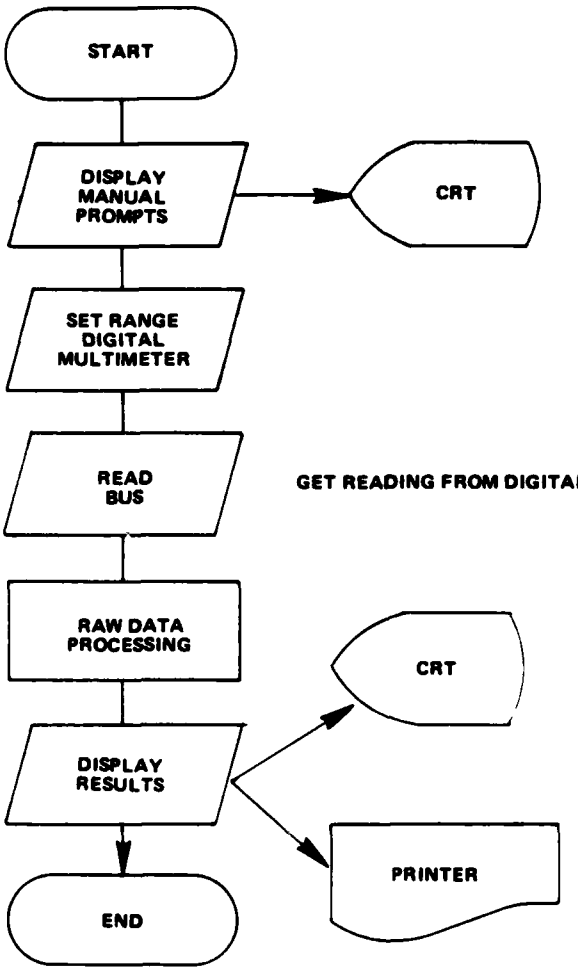
PROGRAM MODULE NAME: _____




A
B
NO
FREQ. CHECK
+10 MHz L1 & L2
+665 MHz (RANGE)
YES
RAW DATA PROCESSING
CRT
DISPLAY RESULTS
PLOTTER
PRINTER
C
NO
DONE TESTING
YES
END
TEST MENU
1. FRPA APERTURE VSWR
2. CRPA APERTURE VSWR
(REF INPUT)
(AUX INPUTS)

CONTINUITY CHECK

PROGRAM MODULE NAME: _____



1. POWER ON
2. SET MANUAL INPUTS
3. MAKE CONNECTIONS
4. PRESS [RET] WHEN READY.

GET READING FROM DIGITAL MULTIMETER

TEST MENU

1. FRPA CONTINUITY CHECK
2. CRPA CONTINUITY CHECK

5.0 SPECIAL HARDWARE REQUIREMENTS

This section contains the special purpose hardware requirements needed to perform the bench tests on the GPS UE. This section is limited in detail due to the lack of information currently available. This section will be expanded as more detailed information becomes available.

The GPS signal simulation will be produced by the Satellite Signal Generator (SSG). The SSG is capable of generating numerous signals. For example, the SSG can generate in addition to the composite GPS signal, the P-code, C/A code, square waves at the P and C/A chip rates, IF frequencies, etc. Any combination of these may also be selected. With this capability there is no need to purchase any special coders and generators.

It will be necessary to buy some attenuators to control the output level, combiners, and mixers to provide some of the various signal combinations. Several breakout boards will be needed to provide various signal levels from one input.

END

DTIC

5-86